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REPORT FOR CONSULTATION ON THE METROPOLITAN LOS ANGELES AIR QUALITY CONTROL REGION

National Air Pollution Control Administration
Washington, D. C.

November 1968

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METROPOLITAN LOS ANGELES

AIR QUALITY CONTROL REGION

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U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Consumer Protection and Environmental Health Service
National Air Pollution Control Administration

November 1968

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PREFACE

The Secretary, Department of Health, Education, and Welfare, is directed by the Air Quality Act of 1967 to designate "air quality control regions" to provide a basis for the establishment of air quality standards and the implementation of air quality control programs. In addition to listing the major factors to be considered in the development of region boundaries, the Act stipulates that the designation of a region shall be preceded by consultation with appropriate State and local authorities.

The National Air Pollution Control Administration, DHEW, has conducted a study of the Metropolitan Los Angeles urban area, the results of which are presented in this report. The Region* boundaries proposed in this report reflect consideration of all available and pertinent data; however, the boundaries remain subject to revision suggested by consultation with State and local authorities. Formal designation will be withheld pending the outcome of that meeting. This report is intended to serve as the starting point for the consultation.

The Administration is appreciative of assistance received either directly during the course of this study or indirectly during previous studies from the official air pollution agencies of the affected counties and the Air Resources Board and the Bureau of Air Sanitation of the State of California. Useful data was also supplied by local and State transportation and planning agencies and Chambers of Commerce.

*For the purposes of this report, the word region, when capitalized, will refer to the Los Angeles Basin Air Quality Control Region. When not capitalized, unless otherwise noted, it will refer to air quality control regions in general.

INTRODUCTION

> "For the purpose of establishing ambient air quality standards pursuant to section 108, and for administrative and other purposes, the Secretary, after consultation with appropriate State and local authorities shall, to the extent feasible, within 18 months after the date of enactment of the Air Quality Act of 1967 designate air quality control regions based on jurisdictional boundaries, urban-industrial concentrations, and other factors including atmospheric areas necessary to provide adequate implementation of air quality standards. The Secretary may from time to time thereafter, as he determines necessary to protect the public health and welfare and after consultation with appropriate State and local authorities, revise the designation of such regions and designate additional air quality control regions. The Secretary shall immediately notify the Governor or Governors of the affected State or States of such designation."
>
> Section 107 (a), Air Quality Act of 1967

Air pollution, because of its direct relationship to people and their activities, is an urban problem. Because of the nature of urban areas, air pollution is also a regional problem. Urban sprawls often cover thousands of square miles; they quite often include parts of more than one state and almost always are made up of several counties and an even greater number of cities. Therefore, the collaboration of several governmental jurisdictions is prerequisite to the solution of the problem in any given area. Air quality control regions called for in the above-quoted section of the Air Quality Act of 1967 are meant to define the geographical extent of air pollution problems in different urban areas and the combination of jurisdictions that must contribute to the solution in each.

The regional approach set up by the Air Quality Act is illustrated in Figure 1. The approach involves a series of steps to be taken by Federal, State, and local governments, beginning with the designation of regions, the publication of air quality criteria, and the publication of information on available control techniques by the Federal Government. Following the completion of these three steps, the Governor(s) of the State(s) affected by a region must file with the Secretary within 90 days a letter of intent, indicating that the State(s) will adopt within 180 days ambient air quality standards for the pollutants covered by the published criteria and control technology documents and adopt within an additional 180 days plans for the implementation, maintenance, and enforcement of those standards in the designated air quality control regions.

The new Federal legislation provides for a regional attack on air pollution and, at the same time, allows latitude in the form which regional efforts may take. While the Secretary reserves approval authority, the State(s) involved in a designated region assumes the responsibility for developing standards and an implementation plan which includes administrative procedures for abatement and control.

The basic objective in the designation of an air quality control region is that it be self-contained, i.e. that the transfer of air pollution out of or into a region is minimized. This objective recognizes the fact that an air quality control region cannot be delineated in a way to make it completely independent with respect to the air pollution problem. Because air pollutants can be carried long distances, the air over a region can be subjected occasionally or even frequently to trace amounts

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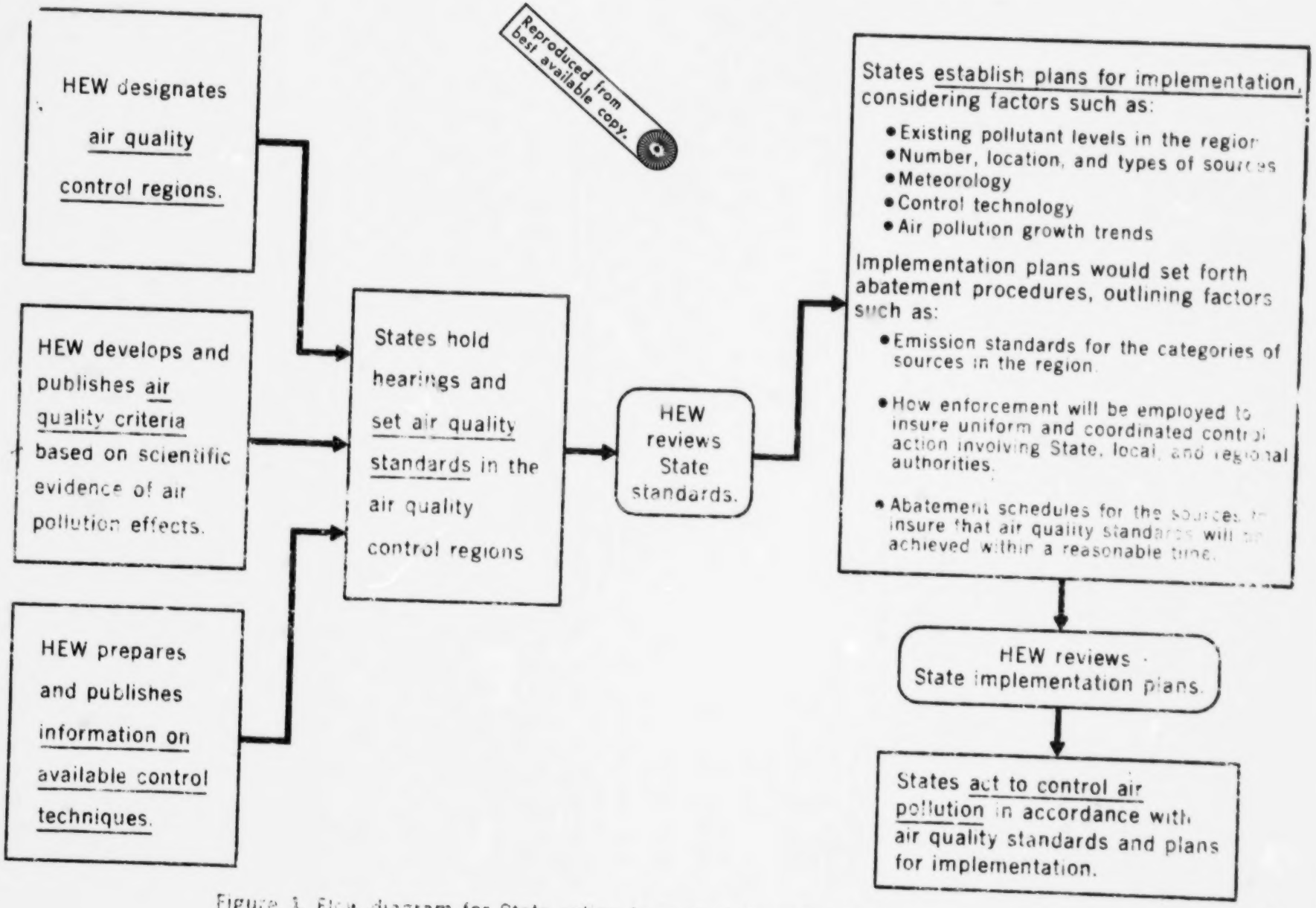

HEW designates air quality control regions.
HEW develops and publishes air quality criteria based on scientific evidence of air pollution effects.
HEW prepares and publishes information on available control techniques.
States hold hearings and set air quality standards in the air quality control regions
HEW reviews State standards.
States establish plans for implementation, considering factors such as:
• Existing pollutant levels in the region
• Number, location, and types of sources
• Meteorology
• Control technology
• Air pollution growth trends
Implementation plans would set forth abatement procedures, outlining factors such as:
• Emission standards for the categories of sources in the region.
• How enforcement will be employed to insure uniform and coordinated control action involving State, local, and regional authorities.
• Abatement schedules for the sources to insure that air quality standards will be achieved within a reasonable time.
HEW reviews State implementation plans.
States act to control air pollution in accordance with air quality standards and plans for implementation.

Figure 1. Flow diagram for State action to control air pollution on a regional basis.

of pollution from other cities and individual sources located outside its boundaries. Under specific and episodal conditions such contributions can even reach significant quantities. The problem of boundary designation is further compounded in that urban areas generally do not end abruptly but are surrounded by activities that can contribute to the pollution of the urban area as well as be the recipients of its generated pollution. Consideration of all these possibilities would result in regions substantially larger than is practical or even necessary to get to the brunt of the problem. The primary question, therefore, becomes one of relative magnitude and frequency.

The boundaries of regions should encompass, however, areas that contain sources that add significantly to the pollution load of the air as well as the areas that are significantly and continuously affected by it. For this purpose, the delineation of regional boundaries is based on evaluation of annual and seasonal air pollutant emissions and resultant ambient concentrations rather than those based on short-term and specific conditions.

The selection of regional boundaries should not be based solely on today's conditions and needs but, perhaps more importantly, should give consideration to future development and growth of the area. For this purpose, extensive consideration should be given to prescribed metropolitan plans as well as the forecasted growth. Such considerations should result in the designation of regions that will contain the sources and receptors of regional air pollution for a number of years to come. This is not to say that the regional boundaries should remain stationary and unchanged. Periodic review of boundaries is desirable, and changes in the boundary should be considered if conditions warrant.

The delineation of region boundaries solely on the basis of source locations and distributional patterns of ambient air pollution would most likely result in regions that do not follow any existing governmental boundaries, are difficult to define, and, more importantly, extremely difficult if not impossible to administrate. It is for this purpose that existing jurisdictional entities are reviewed and wherein practical the boundary lines of a region should include that combination of whole jurisdictions that encompasses the problem area. There can be exceptions to this philosophy, however. The presence of overly large jurisdictions, marked topographical features (mountains), or notable differences in development within a given jurisdiction may make it desirable to include only portions of some jurisdictions.

A region, then, will represent a balance between the various objectives discussed so far to the extent that any two of them lead to different conclusions. The strength of some factors over others may lead to region boundaries which exclude some sources of pollution that might affect the air quality of part or all of the nearby region under certain conditions. Even though the impact of such sources would probably be minimal, the implementation plan required under the Air Quality Act for the region should provide a mechanism for the control of point sources that are located just beyond the region boundary. Such a provision would be consistent with the basic objective of providing desirable air quality within an area being designated as an air quality control region.

The designation of each air quality control region involves three major steps: 1) a report which documents the evaluation of the area and proposes the boundaries of the region; 2) a consultation with appropriate

State and local authorities; and 3) final designation by the Secretary, HEW. The report documenting all of the factors considered is prepared to serve as the basis of the consultation, and the region proposed therein is subject to change following the consultation and prior to final designation by the Secretary, HEW.

Reserving for the moment the question of existing jurisdictional patterns, the distribution of average air quality levels gives the clearest indication of the geographical extent of the problem and, thus, the necessary size of the region. In most instances, however, inadequate air quality data make it necessary to analyze additional factors that serve as indicators of the problem area. Foremost among these additional factors is topography. Where mountains or substantial hills exist, they tend to delineate the outer limit of an urban air pollution problem. First, the mere existence of the mountainous terrain influences heavily the pattern and extent of urban development and thus the location of pollution sources. Secondly, mountains tend to channel the air flow, with the result that net pollutant transport tends to parallel the mountains. Thirdly, even when the air flows from the source area toward and over the mountains, the resultant ground-level concentration of the pollutant beyond the mountains will be much less than if the mountains were not there.

A second important factor is the meteorology of the area. Without discounting the impact of topographical features, the frequency of wind speed and direction, together with vertical temperature profiles, play a major role in the transport of pollution from sources to ground-level receptors. A third major factor is the location of the sources themselves

and the kinds and quantities of pollutants released from them. As modified by the surrounding topography and the meteorological conditions, the quantity and location of pollutant emissions will determine the resultant quality of the surrounding air mass.

Information on current industrial, commercial, and residential land use, transportation systems, and population density is of direct value in that it illustrates generally the location of industry and people in an urban area. Furthermore, it is through an evaluation of estimated patterns of future land use and population density that the air quality control region can be designed to provide for future growth and expansion of the urban area.

THE METROPOLITAN LOS ANGELES AIR QUALITY CONTROL REGION

DATA

The many years of concern over air pollution in the Los Angeles area made this evaluation somewhat unique compared to those of other air quality control regions to date. Numerous studies have been made of the problem and its various aspects. The meteorology of the Los Angeles Basin is as well documented as that of any urban area in the country. State and local air monitoring activities are extensive. Current summaries of pollutant emissions are available for most of the counties involved. Active county and regional planning groups have documented various demographic factors such as population density, land use, and transportation networks, and they have projected each of these factors to future years.

Almost every analysis of air pollution in the Los Angeles area begins by pointing out the importance of the topographical setting. The ring of mountains presents a natural barrier to the transport of pollutants and offers itself as a boundary of the Metropolitan Los Angeles air pollution problem.

There are, of course, two other possibilities: 1) conditions might be such at some points that air quality beyond the mountain perimeter is affected to the extent that the Region should reach beyond the mountains; or 2) at other points within the encircling mountains, the air pollution problem may not be significant enough or, even if significant, not enough related to the problem centered in the Los Angeles area to justify its inclusion in the Metropolitan Los Angeles Region. The following data are presented in order that these various possibilities can be evaluated and the most reasonable boundary location thus determined.

Figure 2 illustrates the topography of the south-coastal California area. Beginning in the Point Arguello - Point Conception area in Santa Barbara County, there is a succession of mountain ranges that reach all the way to the California - Mexico Border. The ridge of the Santa Ynez Mountains runs parallel to the south coast of Santa Barbara County at elevations of 1500 to 2500 feet or more. These mountains rise abruptly from the coast, leaving only a narrow (less than ten miles) coastal plain.

The Santa Ynez Mountains blend into the Sierra Madre Mountains in the vicinity of the Santa Barbara - Ventura County line. Rising up from the Santa Clara Valley in Ventura County, the Sierra Madres reach elevations in excess of 7500 feet at the northern Ventura County line. Thus the entire northern half of Ventura County is mountainous. The extension of the Sierra Madres reaches from the northwest corner of Los Angeles County and connects with the San Gabriel Mountains in the central part of the County. The San Gabriels reach elevations in excess of 7500 feet as they extend eastward into San Bernardino County.

The San Gabriel and San Bernardino Mountains are separated only by Cajon Pass (elevation, 4200 feet). The San Bernardino Mountains (over 7500 feet) bend southward some 40 miles from the Los Angeles County line and extend into Riverside County. The San Jacinto Mountains run northwest-southeast through Riverside County, parallel to and about 60 miles from the coast. The San Jacinto and Santa Rosa Mountains connect in the vicinity of the Riverside - San Diego County line. The Vallecito Mountains begin at the southern end of the Santa Rosas in central San Diego County and reach down into Mexico.

The smoothed 2500 foot contour on the basin side of this series of

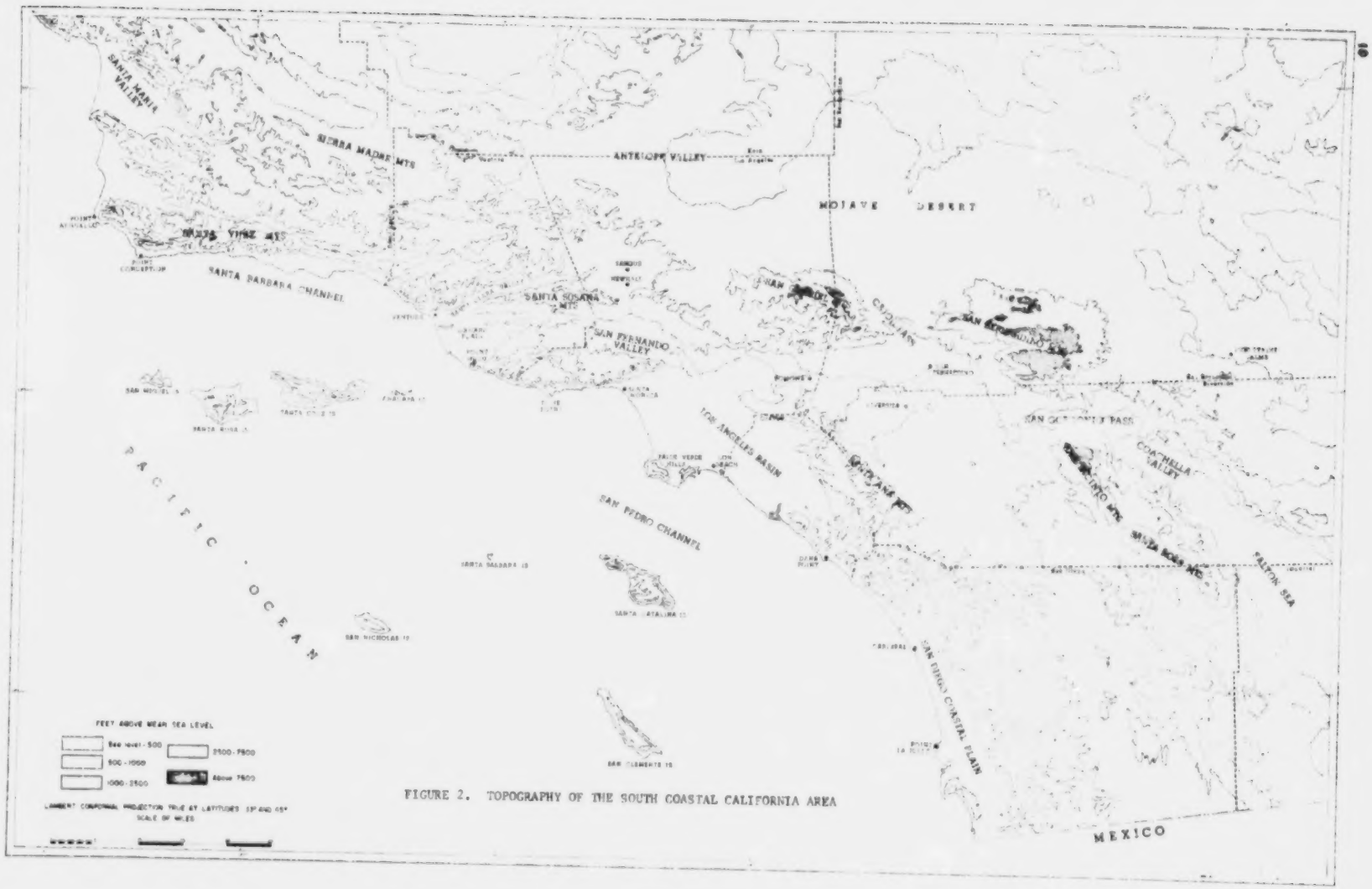


FIGURE 2. TOPOGRAPHY OF THE SOUTH COASTAL CALIFORNIA AREA

Table 1. Land Area by County

County	Area, sq. miles	
	Total[a]	Basin[b]
Santa Barbara	2,738	400
Ventura	1,853	1,000
Los Angeles	4,069	1,900
San Bernardino	20,118	450
Riverside	7,176	1,650
Orange	782	782
San Diego	4,262	1,700

[a]California Population - 1967. Department of Finance, State of California. October 1967. Page 23.

[b]Estimates include the land between the coast and the 2500 foot contour line (see figure 3.).

mountains is shown in Figure 3. It is a continuous line from the California - Mexico border across San Diego, Riverside, San Bernardino, Los Angeles, and Ventura Counties. The contour becomes discontinuous in Santa Barbara County. Those areas where the mountains reach 5000 feet or more are also shown. Also shown on this Figure are two minor mountain ranges that lie within the basin area, the Santa Susana Mountains on the Ventura - Los Angeles County line, and the Santa Ana Mountains separating Orange and Riverside Counties. Table 1 lists the seven counties mentioned and shows the total area of each and the approximate area of each between the coast and the 2500 foot contour line.

Now, with respect to the boundary questions posed earlier, if the mountains preclude transport of pollutants and the entire basin is involved in the same air pollution problem, the Region should include the basin portion of each county. This would mean that all of Orange, and about 40% of San Diego, 25% of Riverside, 2% of San Bernardino, 30% of Ventura and Los Angeles, and 15% of Santa Barbara would be in the Region. On the other hand, data presented below may suggest that the Region should reach beyond the encircling mountains in some places and that it need not even reach the mountains in other places. The remainder of this discussion is addressed to these possibilities.

Figures 4 and 5 show the pattern of urban development in the basin area. Figure 4 is based on 1960 land use in the Los Angeles Regional Transportation Study area[1] and Figure 5 on work conducted by the San Diego County Regional Planning Commission[2]. The impact of the mountains in Los Angeles County is obvious; even in 1960 the entire basin portion of Los Angeles County was well developed right up into the mountain

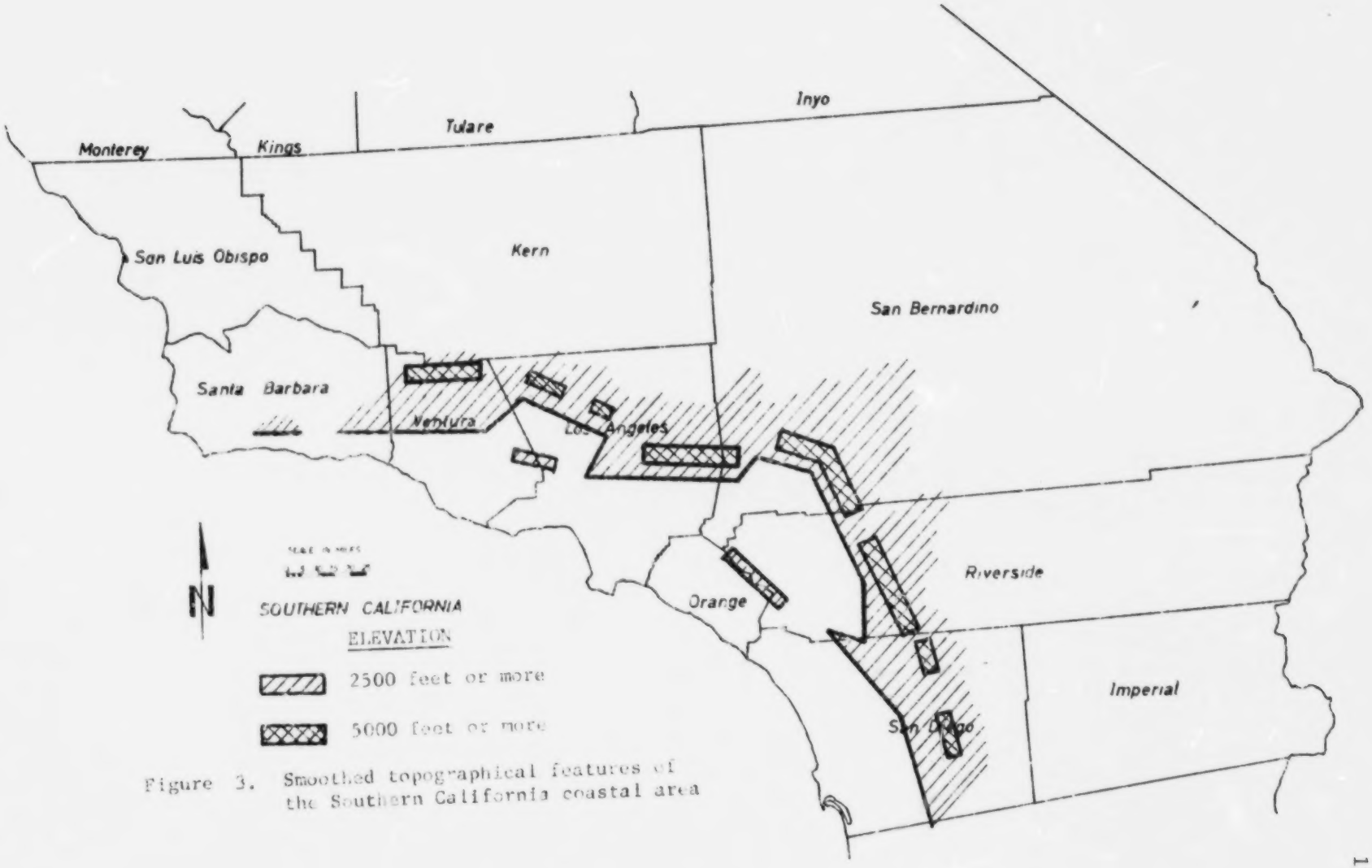


Figure 3. Smoothed topographical features of the Southern California coastal area

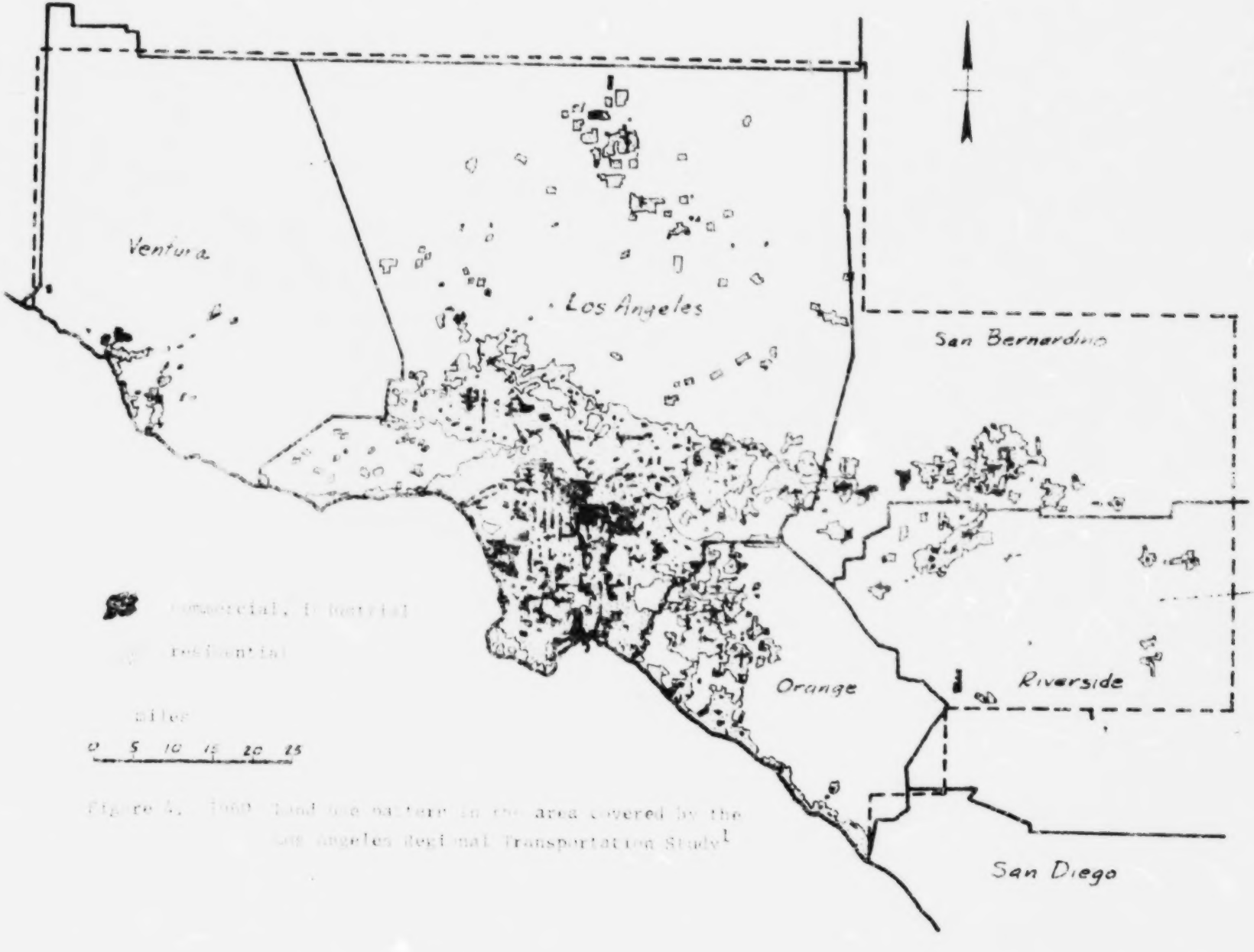


Figure 4. 1960 land use pattern in the area covered by the Los Angeles Regional Transportation Study[1]

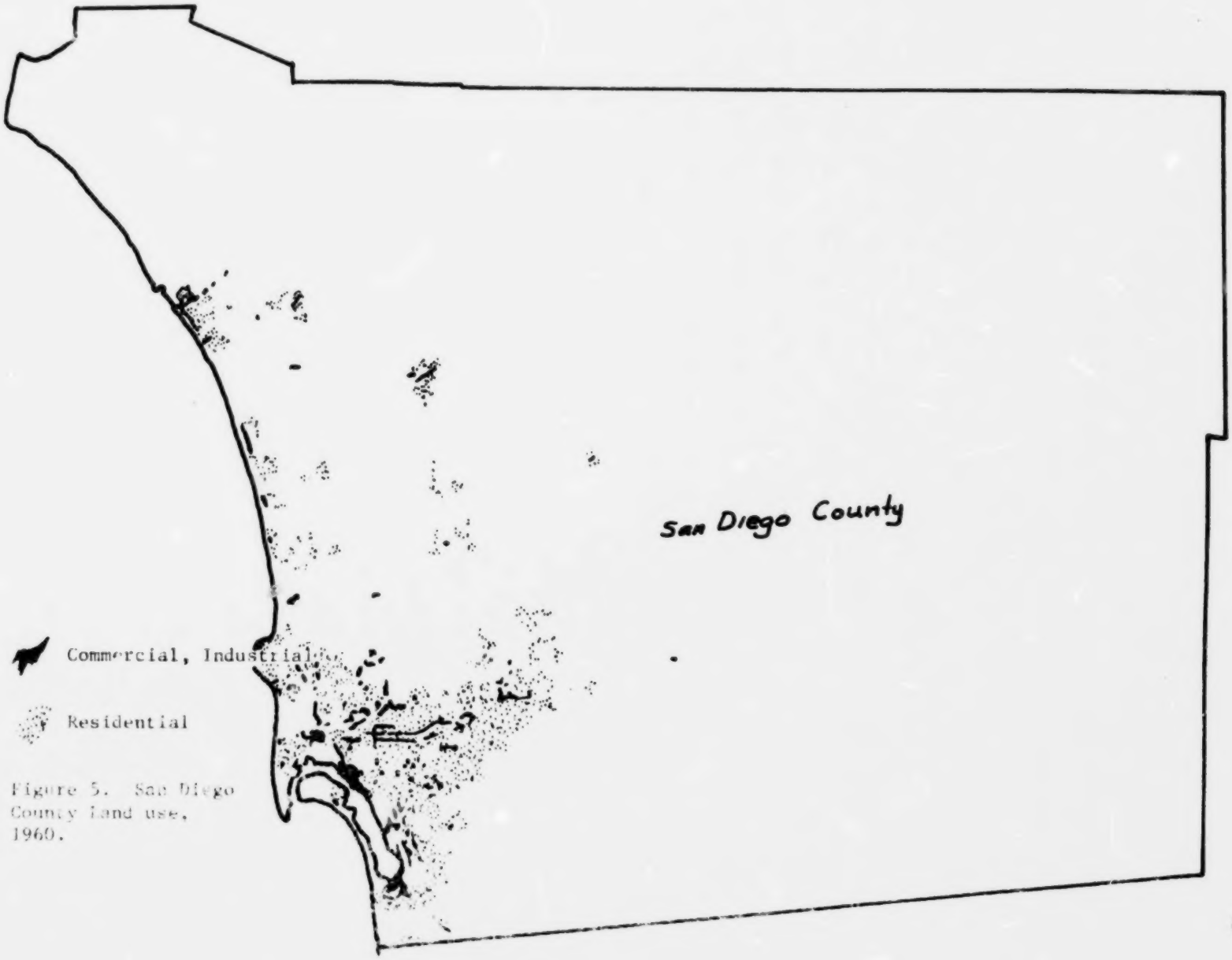


Figure 5. San Diego County land use, 1960.

foothils, including the San Fernando Valley.

The development in the Antelope Valley in the northeast corner of Los Angeles County is completely separated from that of the basin. On the other hand, the basin portions of Ventura, San Bernardino, Riverside, and Orange Counties were not completely developed in 1960. Settlement in Ventura County was primarily in the Ventura (city) and Oxnard area, somewhat separated from Los Angeles County. Most of the development in Orange County in 1960 was in the northwestern part adjacent to Los Angeles County. Residential development extended along the coast.

The major industrial, commercial, and residential development in San Bernardino and Riverside Counties in 1960 was centered around the two cities, San Bernardino and Riverside. More recent data (1965) show relatively little development of the basin portion of San Diego County beyond the city of San Diego itself and its immediate suburbs. Development northward along the coast from San Diego is primarily residential and even that is separated from the Los Angeles - Orange County area by Camp Pendelton which occupies some 250 square miles of area in northernmost San Diego County. Development along the south coast of Santa Barbara was in 1960 and still is today somewhat intermittent and almost totally residential in character.

Figure 6 shows the 1960 population density of the LARTS area[1]. As expected it parallels the land use pattern, with the heaviest densities occuring in the City of Los Angeles. Only with a few exceptions did population density outside of Los Angeles County exceed eight persons per gross acre in 1960. More current data from individual planning agencies[3-9] show that Orange County is the fastest growing of those

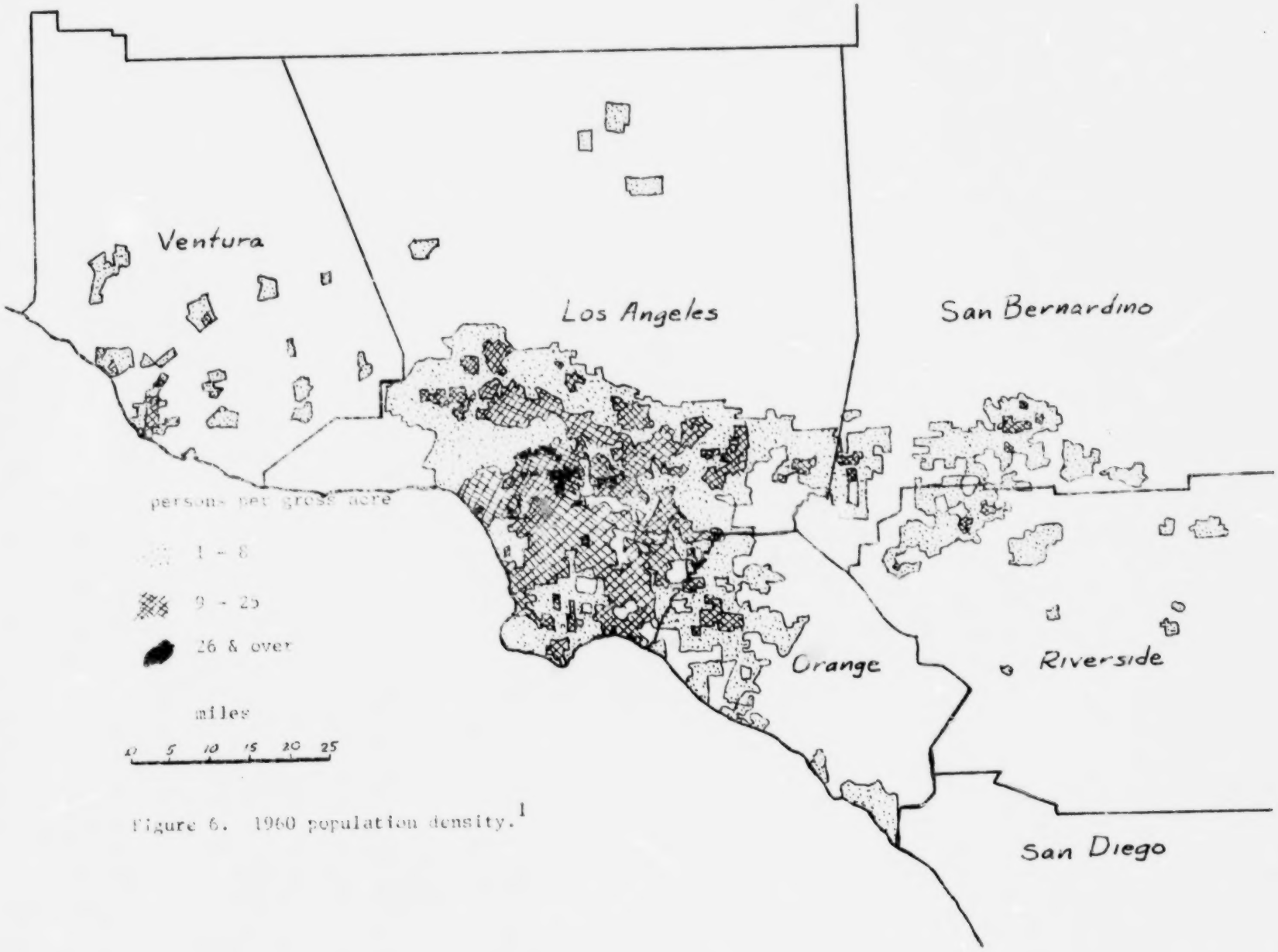


Figure 6. 1960 population density.[1]

in question. In 1967, Orange County was second only to Los Angeles County in population density.[10] Current population figures for all seven counties are shown in Table 2.

The pattern of residential, commercial and industrial land use is indicative of the location of pollutant sources of various categories. For instance, peoples' desires for places to live and places to work determine in part the transportation system necessary to transport people and goods. Figure 7 shows the freeway and expressway system for the LARTS area[1] for 1960, and that proposed for 1980. The location and density of major arterials is an important consideration since it illustrates the relative vehicle mileage and thus the relative density of pollutant emission from mobile sources.

Figure 8 through 12 show the location of power generating facilities and major (100 or more employees) selected industrial plants in each of several industrial categories of concern because of their potential for polluting the atmosphere. The best way to illustrate the geographical spread of sources and emissions of air pollution in an area is through the use of emission density maps which present emissions in terms of tons of pollutant per unit area. These maps would be of particular value in illustrating the continuity of geographic distribution of emissions which may suggest areas for inclusion or exclusion from the region. The absence of data in enough detail to construct such density maps makes it necessary to use alternate means to depict the location and number of pollutant sources.

Table 3 shows approximate number of establishments by selected industrial categories in each of the counties. These data, which were extracted from appropriate Directories of Manufacturers, 11-16, are

Table 2. Existing and Projected Population by County

County	1967 [a]	1980	Percent Change
1. Santa Barbara	249,800	365,000 [b]	+ 46.5
2. Ventura	330,800	1,077,000 [c]	+ 226
3. Los Angeles	7,032,400	9,000,000 [d]	+ 27.9
4. San Bernardino	667,700	1,106,000 [e]	+ 65.6
5. Riverside	444,000	895,000 [f]	+ 102
6. Orange	1,268,900	2,280,000 [g]	+ 80
7. San Diego	1,283,200	1,900,000 [h]	+ 48
Total	11,276,800	16,624,000	+ 47.4

Sources

a. California Population - 1967. Department of Finance. Sacremento, Cal. October, 1967. p. 17.

b. Population Estimates for Santa Barbar County. Santa Barbara Co. Planning Dept., 10/1/68 Rev.

c. Revised Population Forecast. Ventura County Planning Department. December, 1967.

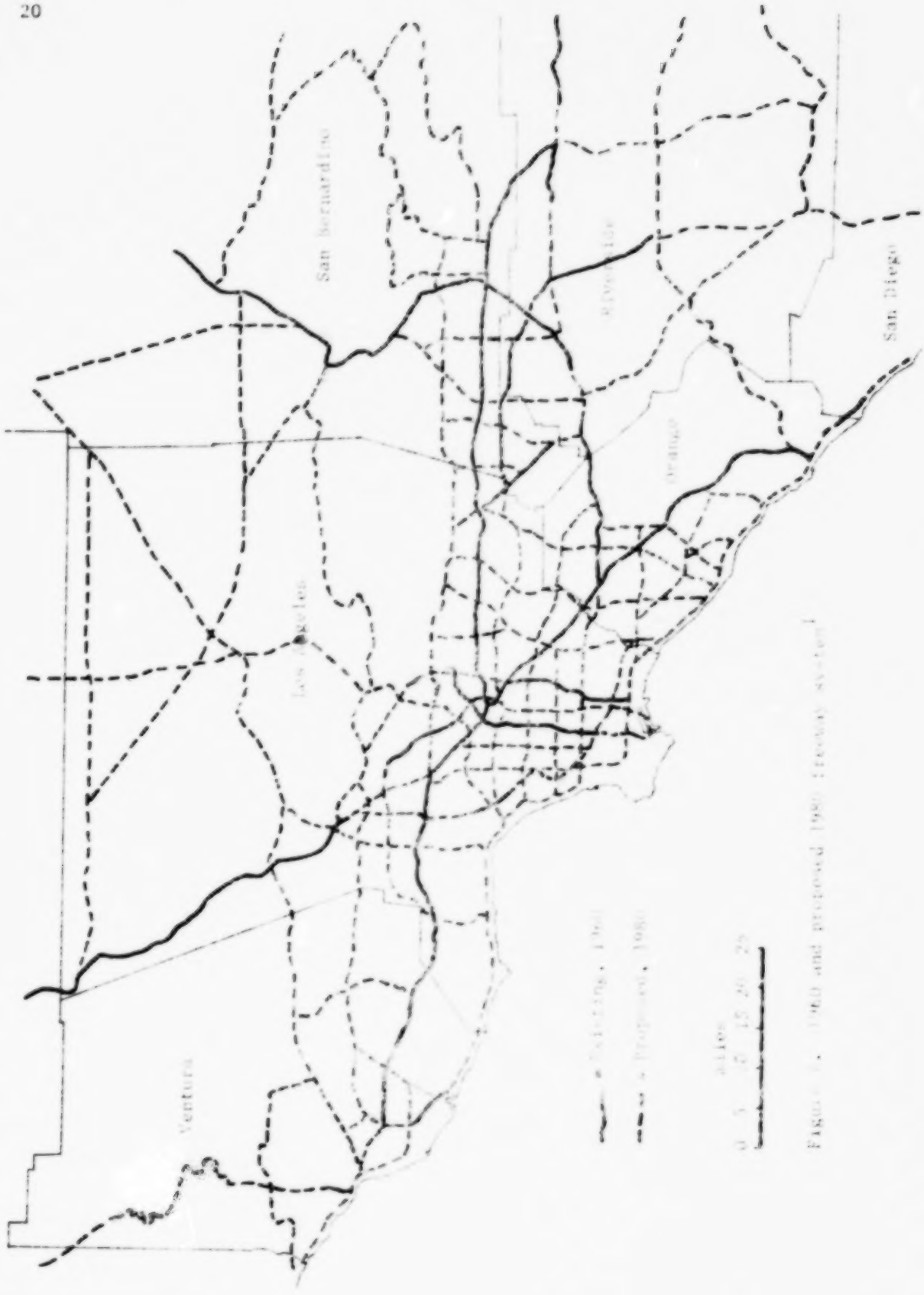
d. Population of Los Angeles County, 1965 - 1985 (Revised, Aug 66). Los Angeles County Regional Planning Commission. Feb. '67. p. 3.

e. San Bernardino County Population Trends & Projections. San Bernardino County Planning Dept. May, 1967.

f. Population Study, Riverside County. Department of Development, Riverside County. March, 1961.

g. Population by Statistical Area (Revised, April, '68) Orange County Planning Dept.

h. San Diego County Population Projections, 1990. Regional Plan Bulletin. San Diego County Planning Department. January, 1967.


San Bernardino
Riverside
San Diego
Los Angeles
Orange
Ventura

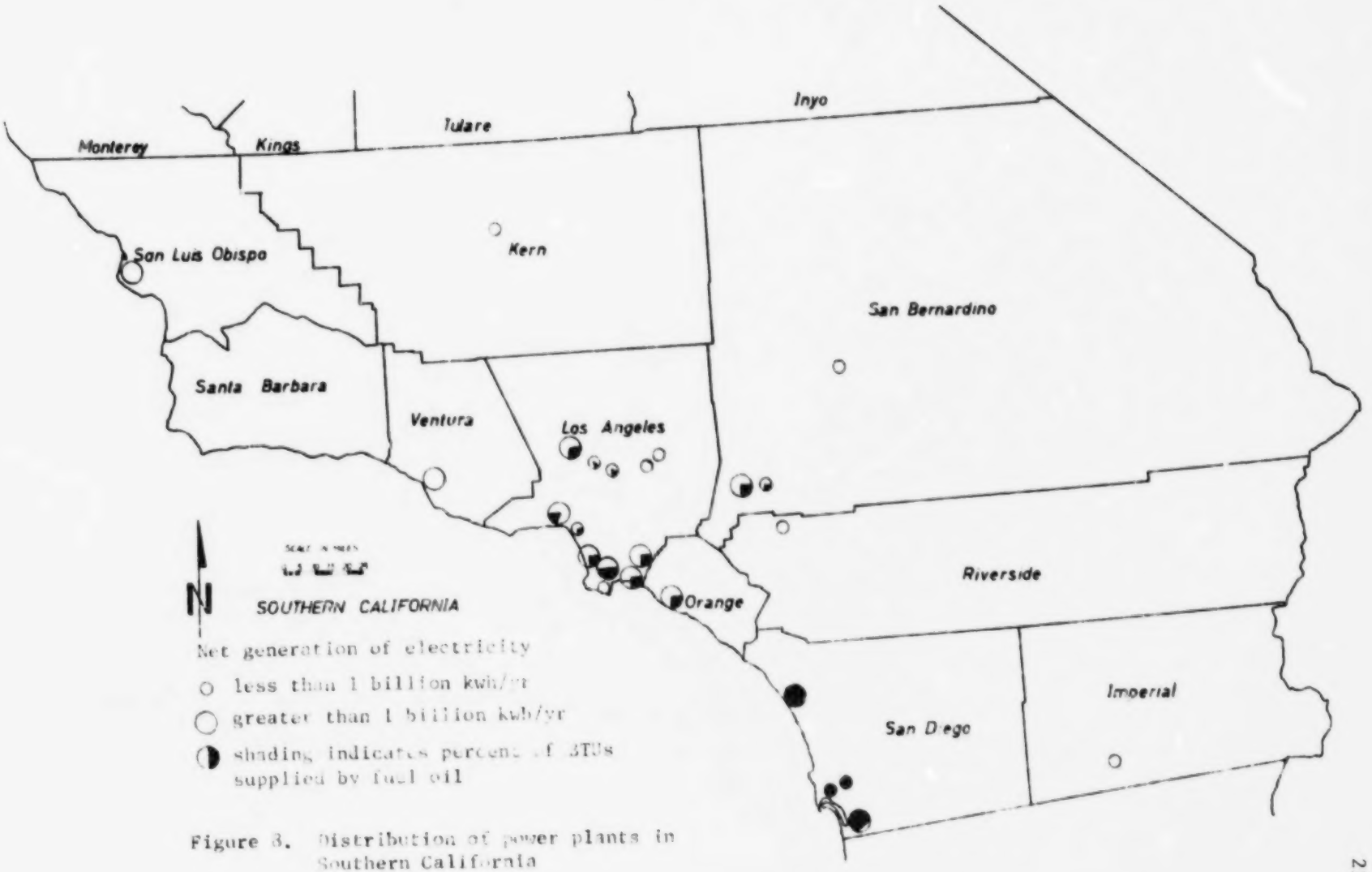


Figure 8. Distribution of power plants in Southern California

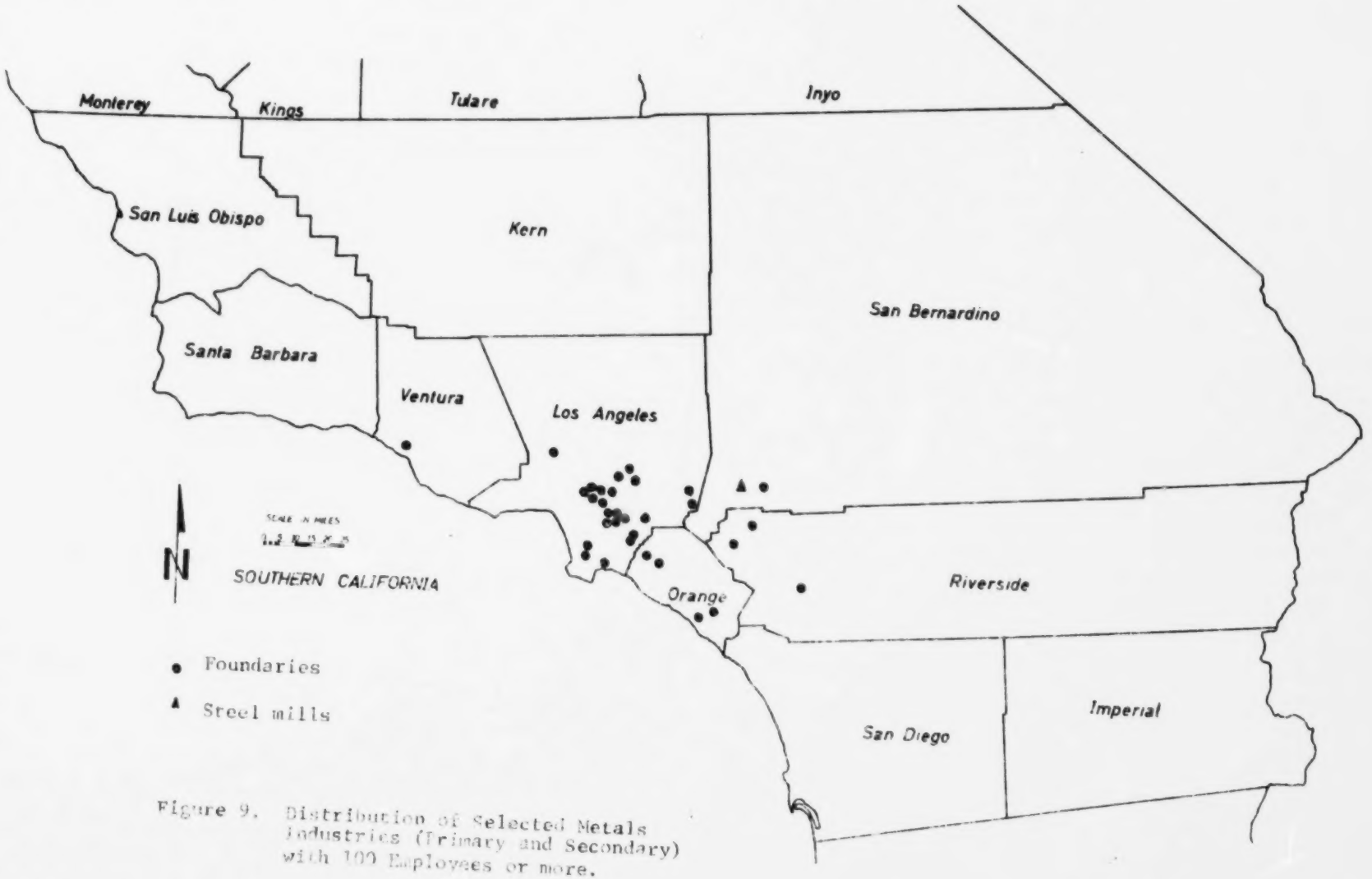


Figure 9. Distribution of Selected Metals Industries (Primary and Secondary) with 100 Employees or more.

Figure 10. Distribution of Selected Chemical and Allied Industries with 100 Employees or more

Figure 11. Distribution of Selected Stone, Clay, and Glass Industries with 100 Employees or more.

Figure 12. Distribution of Selected Petroleum Industries with 100 Employees or more.

Table 3. Number of Industrial Establishments
by S I C Category

County	Chemicals & Allied Products #28		Petroleum #29		Stone, Clay and Glass #32		Primary Metals #33		Total	
	<100*	>100	<100	>100	<100	>100	<100	>100	<100	>100
Los Angeles	21	24	8	22	14	11	21	21	64	78
Orange	17	9	0	1	12	2	8	4	37	16
Riverside	9	1	1	0	14	6	7	3	31	10
San Bernardino	25	3	7	1	45	8	11	2	89	16
San Diego	19	2	2	0	32	4	8	0	61	6
Ventura	8	2	10	3	17	1	2	1	37	7
Total	99	41	28	27	134	32	57	31	319	133

approximate rather than complete, in that only those sub-categories of interest in air pollution are included in the totals. This table shows that Los Angeles County has the largest share of establishments employing over 100 people, whereas the establishments employing less that 100 are more evenly distributed among the counties. Figures 8 through 12 show the locations of plants with 100 or more employees for each of the categories considered. These figures portray possible pollution sources as adjudged by the SIC number assigned to the establishment and the products listed for each. For example, Figure 9 shows the establishments that produce metals and related alloys but does not include the establishments that utilize the resulting metal in the manufacture of a desired product.

Emission inventory data by county is summarized in Table 4 and further subdivided by source category in Table 5. The information presienting in these tables were extracted and compiled from references 17 through 21 which were performed by the respective air pollution control districts. Although these inventories are not tabulated for a common base year, the information presented herein should be adequate for the analyses made in this report.

As shown in Table 4, more than 20,000 tons of pollutants are emitted daily to the atmosphere of the six-county area (does not include Santa Barbara County). The emissions from Los Angeles County, which comprises only about 10 percent of the land area of these counties account for over 60 percent of the total emissions. The remaining 30 to 40 percent is about evenly divided among the other five counties with approximate percentages ranging from 10 percent for San Bernardino County to about four percent for Ventura County. Emissions in Santa Barbara Count

Table 4. Summary of Air Pollutant Emissions in Southern California Counties

County	Emissions (tons/day)					
	Particulates	Oxides of Sulfur	Carbon Monoxide	Oxides of Nitrogen	Hydrocarbons	Total
1. Los Angeles	120	308	10,045	935	2,590	13,998
2. Orange	NA	NA	NA	NA	NA	NA
3. Riverside	36	5	640	34	168	883
4. San Bernardino	54	117	1,060	140	224	1,595
5. San Diego	48	28	1,470	131	393	2,070
6. Ventura	32	4	510	51	126	723
Total	290	462	13,725	1,291	3,501	19,269

NA Not available

Table 5. Summary of Air Pollutant Emissions in Southern California Counties by Source Category

Source Category / County	E M I S S I O N S (tons/day)				
	Particulates	Oxides of Sulfur	Carbon Monoxide	Oxides Nitrogen	Hydro Carbons
TRANSPORTATION	95	51	13,462	787	2,512
1. Los Angeles Co.	65	35	9965	605	1830
2. Orange Co.	NA	NA	NA	NA	NA
3. Riverside Co.	6	2	545	30	115
4. San Bernardino Co.	12	6	1052	57	205
5. San Diego Co.	9	6	1442	70	268
6. Ventura Co.	3	2	458	25	94
FUEL COMBUSTION-STATIONARY SOURCES	32	242	2	442	22
1. Los Angeles	20	165	1	280	9
2. Orange	NA	NA	NA	NA	NA
3. Riverside	1	2	-	5	-
4. San Bernardino	4	52	-	83	10
5. San Diego	6	22	1	60	3
6. Ventura	1	1	-	14	-
REFUSE DISPOSAL	45	-	147	2	87
1. Los Angeles	1	-	1	1	1
2. Orange	NA	NA	NA	NA	NA
3. Riverside	6	-	80	-	33
4. San Bernardino	10	-	7	-	-
5. San Diego	11	-	20	1	51
6. Ventura	17	-	39	-	2
PROCESS EMISSIONS	109	168	73	60	853
1. Los Angeles	34	108	78	49	750
2. Orange	NA	NA	NA	NA	NA
3. Riverside	23	-	-	-	14
4. San Bernardino	28	59	-	-	8
5. San Diego	20	-	-	-	56
6. Ventura	4	1	-	11	25
AGRICULTURAL	11	NA	34	NA	27
1. Los Angeles	-	-	-	-	-
2. Orange	NA	NA	NA	NA	NA
3. Riverside	1	-	15	-	6
4. San Bernardino	NA	NA	NA	NA	NA
5. San Diego	2	-	6	-	15
6. Ventura	8	-	13	NA	6

are low compared to those covered in Table 4.

Although there are about 38,000 square miles of area in the six counties, over 80 percent, or about 30,000 square miles, are located on the eastern side of the mountains and are relatively barren with respect to population as well as sources of pollution, For example, Riverside County has estimated that only about 20 percent of their total emissions of 900 tons per day occur on the eastern side which constitutes almost 80 percent of land area of the county. Although similar breakdowns for San Bernardino and San Diego Counties were not available, the same type of geographical distribution can be expected within these counties, i.e. that most of the sources and emissions are located on the coastal side.

To provide an inidcation of the relative distributions of air pollutant emissions within the area, Table 6 presents average emissions densities of pollution. For purposes of this comparison only the land area west of the mountains was used and it was assumed that the relative breakdown of emissions between the eastern and western portions of San Bernardino and San Diego County is the same as that shown for Riverside County. The densities so calculated, which should be viewed in terms of these assumptions, show that emissions of the five pollutants range from a high of 7.4 tons per square mile per year in Los Angeles County to less than 1 ton per square mile per year in Riverside and Ventura Counties.

In previous analysis of earlier air quality control regions. the affect of meteorology on air quality was accounted for in part through the use of mathematical diffusion modeling[22]. The use of this model, however, is restricted to areas where topography is relatively flat

Table 6. Estimated Emission Densities

County	Area Included (sq. mi.)	Total Emissions[b] (tons/day)	Density (tons/sq. mi./day)
1. Los Angeles	1900[a]	14000	7.4
2. Orange	782	N.A.[c]	N.A.
3. Riverside	1650[a]	683	0.4
4. San Bernardino	450[a]	1275	2.8
5. San Diego	1700[a]	2070	1.2
6. Ventura	1000[a]	723	0.7
Total	7480	18750	2.5

[a] Estimates include the land between the coast and the 2500-foot contour line (see Figure 3.).

[b] Includes emissions of carbon monoxide, particulates, oxides of sulfur, oxides of nitrogen and hydrocarbons from all sources emitted in the valley portion.

[c] N.A. - not available.

and where patterns of wind direction and speed are relatively uniform throughout the area. Neither of these requirements are satisfied in the Los Angeles area, thus ruling out diffusion modeling. As a substitute, a research of the pertinent literature has been conducted to evaluate air flow patterns, mixing depths, and resultant dilution potential (qualitative only).

Stream-flow or streamline charts and trajectory analyses are frequently used to demonstrate how air moves from one area to another. Numerous reports on air flow patterns have been prepared for areas in southern California (references 23-35). All of these reports tend to support one another in depicting the representative flows for various meteorological conditions. Data from the most recent of the reports (De Marrais, 1965) are used in this evaluation because they gave coverage to the whole area of interest and showed the most detail. Although there are seasonal differences in the flow patterns, the most pronounced differences occur on a diurnal basis. Figures A-1 through A-4 (Appendix) show the day and night flows for July and January.

The July daytime wind data (see Figure A-1) are representative of summer days and show a very marked landward flow of air. The maritime winds reaching the coast vary from south to west northwest. The marked unidirectional movement which is depicted persists during the daylight hours and a substantial part of the night so the net transport of air during the 24-hour period is large. The ready exchange of air between counties is seen as air flows from: 1) Los Angeles to San Bernardino, 2) San Bernardino (and indirectly, Los Angeles) to Riverside, 3) Los Angeles to Orange, 4) Orange to Los Angeles, 5) Orange to Riverside,

6) Ventura to Los Angeles, 7) Santa Barbara (most marine air) to Ventura, and to a much lesser extent 8) Orange to San Diego, and 9) San Diego to Riverside. The mountains act as barriers to the flow with most of the air being forced up on the windward side staying aloft on the leeward side (and having little or no effect at or near the surface). In the channeled flows in the passes the air moves as if in a pipe and does not diffuse as rapidly as it does over open terrain. Channeled flows occur 1) to the east northeast of the Oxnard Plan in Ventura County, 2) through Cajon Pass, 3) through San Gorgonio Pass, and 4) around the sides of the Santa Ana Mountains. Flows through these passes bring air from the windward sides of the mountains to sections on the desert side in the Antelope Valley, Mojave Desert, Coachella Valley and the valley east of the Santa Ana Mountains.

The nighttime flow in July (see Figure A-2) is typical of the summer and is in many places opposite to that which it is in the daytime. The flow for the most part is downslope off the mountains (on both sides) and from land to sea. The major exception is in the Los Angeles area where the general flow at midnight, as shown by the insert in the upper right of Figure A-2, is still from sea to land. The flow from the land to sea gradually overcomes the opposing flow during the night and by 0500 PST, as shown in the main part of Figure A-2, extends out over the water. Similar analyses of exchange from one county to another can be made here as in Figure A-1. Not as obvious becuase most of the air exchange takes place out over the ocean is air moving from Orange to San Diego County and vice versa. Interpolating between the night and daytime flows it appears that, through over-the-water trajectories,

air can move cross-country from 1) Santa Barbara to Ventura and Los Angeles, 2) Ventura to Los Angeles, and 3) Los Angeles to Orange and in some cases to San Diego. There is, however, little data on the frequency of such exchange or the relative impact that it has on air quality in the "receiving" jurisdictions.

The daytime flow in January (see Figure A-3) is very similar to that in the daytime in July. The cross-country and channeled flows are practically identical to the midseason months of summer and winter. The main changes from July to January are: 1) the decrease in frequency of the unidirectional flow (from a range of 70 to 99% of the time down to 35 to 75% at the individual stations) and 2) the decrease in time during which unidirectional flow prevails (in January the flow starts later in the day and seldom prevails into the night).

There is a fairly well marked difference in the nocturnal flows of July and January. In the mid-season winter month (see Figure A-4) the flow down the mountain slopes is the same as in summer but the land to sea flow is much more marked. Everywhere along the coast, with the exception of San Diego County, the flow from over the land readily carries out over the ocean. Air with trajectories over the ocean can readily be carried along the coast from one county to another. Examination of the charts showing the daytime and nocturnal flows for October and April leads one to conclude that the changes in flows from July to January and January to July are gradual[25].

Mixing depth, or the calculated vertical distance through which convective mixing of the air readily occurs, is a measure of air pollution potential of an area. Table 7 shows values considered

representative of the Los Angeles Basin[36] in meters (1 meter=3.28 feet). These values, particularly those of the afternoon are markedly lower than the national average. [37, 38] This means, all other factors being equal, that an air quality problem could develop more readily over Los Angeles than in most places in the United States.

Table 7. Mixing Depths (meters), Los Angeles, California[36,37]

	Summer	Winter	Annual**
Morning	520	360	482
Afternoon	950	875	931
Average*	735	618	706

*of morning and afternoon
**of all 4 seasons

To demonstrate the representativeness of the Los Angeles mixing depth data for other locations, inversion data for radiosonde stations at San Diego, Santa Maria, and Santa Monica (Los Angeles) are shown in Tables A-1 through A-3.[25] The conclusion drawn is that the mixing depth data for Los Angeles is representative of coastal southern California (all of these radiosonde stations are at coastal sites).

Radiosonde data for Edwards Air Force Base[25] in the Majave Desert indicate that the desert side of the mountains has smaller mixing depths in the morning hours because radiational, surface-based inversions develop during most of the nights (see Table A-4). Unfortunately, there are not sufficient daytime data for Edwards to evaluate the daytime mixing but data from China Lake[39], just north of Edwards, indicate that mixing in the daytime takes place through several thousand meters.

There are no radiosonde data for the area surrounded by the San Gabriel, San Bernardino, San Jacinto, and Santa Ana Mountains. Based on the large diurnal temperature variation and low wind speeds in the area[25], it is concluded that the nocturnal radiation inversions occur about as frequently as they do over the Mojave Desert (see Table 11). Morning mixing depths are therefore lower over this area than over the Los Angeles coastal area. Data from a glider pilot-meteorologist[40,41] and fire weather observers[42] indicate that vertical mixing in the afternoon over this area is several thousand feet greater than it is over the coastal sites.

The State of California and the several county air pollution control districts have been conducting air monitoring activities for several years. Discussion here is limited to oxidant concentrations, primarily because of the greater number of sampling sites for this pollutant as compared to others. Tables 8 and 9 show the monthly averages of daily one-hour maximum concentrations of oxidants for 34 locations in the Los Angeles Basin area. The data cover a 12-month period from December 1966 through November 1967, (except stations in Ventura County, where data are for the period May 1965 through April 1966). The numbers in parentheses following the name of each sampling location are used for identification and are used in Figure 13 to show the approximate location of each sampling station.

The twelve monthly values were used to calculate an annual average of daily one-hour maximum oxidant concentrations. The results are shown in Figure 14 in the form of isclines of equal values of annual average daily one-hour maximum concentrations. Strictly speaking, these numbers are not true averages of the 365 one-hour maximums, since they

Table 8. Monthly and Annual Averages of Daily One-Hour Maximum Oxidant Concentrations for Southern California December 1966 through November 1967

Station	(Number)	Monthly Average of Daily One-Hour Maximum Concentration, ppm												Average
		Dec '66	Jan '67	Feb '67	Mar '67	Apr '67	May '67	June '67	July '67	Aug '67	Sept '67	Oct '67	Nov '67	Dec '66-Nov '67
Downtown Los Angeles	(1)	0.04	0.06	0.09	0.09	0.04	0.11	0.10	0.15	0.16	0.11	0.18	0.10	0.10
Azusa	(3)	0.05	0.08	0.11	0.12	0.08	0.17	0.19	0.27	0.33	0.20	0.25	0.12	0.16
Pasadena	(4)	0.03	0.07	0.10	0.09	0.06	0.14	0.15	0.24	0.25	0.19	0.23	0.12	0.14
Burbank	(5)	0.04	0.06	0.07	0.10	0.06	0.15	0.16	0.24	0.24	0.19	0.24	0.12	0.14
USC Medical School	(6)	0.04	0.06	0.08	0.08	0.03	0.10	0.10	0.17	0.16	0.16	0.20	0.10	0.10
West Los Angeles	(7)	0.05	0.07	0.10	0.10	0.06	0.11	0.09	0.12	0.10	0.11	0.17	0.09	0.10
Long Beach	(8)	0.03	0.04	0.05	0.03	0.03	0.07	0.05	0.05	0.07	0.06	0.09	0.04	0.05
Hollywood Freeway	(9)	0.03	0.04	0.05	0.05	0.03	0.07	0.05	--	--	--	--	--	0.05
Reseda	(10)	0.04	0.06	0.09	0.10	0.07	0.14	0.16	0.23	0.20	0.19	0.18	0.12	0.13
Pomona	(11)	0.03	0.05	0.08	0.10	0.07	0.13	0.17	0.26	0.27	0.19	0.21	0.13	0.14
Lennox	(12)	0.04	0.04	0.06	0.06	0.05	0.08	0.06	0.06	0.06	0.08	0.13	0.05	0.06
Anaheim	(13)	0.05	0.07	0.11	0.08	0.06	0.10	0.08	0.12	0.14	0.11	0.15	0.10	0.10
La Habra	(14)	0.04	0.05	0.09	0.07	0.07	0.09	0.08	0.03	0.03	0.10	0.15	--	0.07
Riverside	(15)	0.04	0.05	0.05	0.08	0.09	0.17	0.15	0.26	0.29	0.21	0.15	0.13	0.14
Beaumont	(16)	0.04	0.04	0.04	0.06	0.05	--	--	--	--	0.11	0.08	0.07	0.06
Corona	(17)	0.04	0.06	0.07	0.08	0.07	0.13	0.21	0.24	0.23	0.19	0.21	0.15	0.14

Table 8 - Continued

Station (Number)	Monthly Average of Daily One-Hour Maximum Concentration, ppm												Average Dec '66-Nov '67
	Dec '66	Jan '67	Feb '67	Mar '67	Apr '67	May '67	June '67	July '67	Aug '67	Sept '67	Oct '67	Nov '67	
San Bernardino (18)	0.04	0.04	0.04	0.09	0.06	0.12	0.15	0.22	0.20	0.13	0.12	0.07	0.14
Upland APCD (19)	0.02	0.02	0.03	0.05	0.06	0.05	0.13	0.17	0.19	0.17	0.10	0.04	0.09
Upland UCR #1 (20)	0.04	0.05	0.09	0.11	0.09	0.14	0.17	--	--	0.20	0.24	0.16	0.13
Cucamonga UCR #2 (21)	0.04	0.05	0.08	0.10	0.06	0.16	0.18	0.26	0.26	0.23	0.33	0.19	0.16
Chino Airport (22)	--	--	0.10	0.09	0.07	--	0.14	0.14	0.13	.13	0.13	0.11	0.12
San Diego (23)	0.04	0.05	0.06	0.04	0.04	0.06	0.04	0.05	0.08	0.04	0.07	0.04	0.05
Carlsbad (24)	0.12	0.10	0.16	0.08	0.09	0.13	0.09	0.08	0.11	0.12	0.14	0.11	0.11
Chollas Heights (25)	0.09	0.10	0.14	0.09	0.09	0.12	0.10	--	--	0.10	0.15	0.09	0.11
El Cajon (26)	0.04	0.08	0.10	0.06	0.05	0.08	0.09	0.11	0.10	0.09	0.12	0.06	0.08
Nestor (27)	0.08	0.09	0.12	0.09	0.08	0.08	0.08	0.07	0.09	0.07	0.11	0.09	0.09
Mission Valley (28)	0.05	0.04	0.04	0.04	0.04	0.05	0.08	0.08	0.08	0.06	0.09	0.06	0.06
Santa Ana (29)	--	--	--	--	--	0.08	0.06	0.07	0.09	0.08	0.13	0.10	0.09

-- not available

Note: Numbers in parenthesis after name of each sampling station site is for identification (see Figure 13).

Table 9. Monthly and Annual Averages of Daily One-Hour Maximum Oxidant Concentrations for Ventura County, May, 1965 - April, 1966.

Month	Station (Number)				
	Ojai (30)	Oxnard (31)	Santa Paula (32)	Thousand Oaks (33)	Ventura (34)
May 1965	0.12	0.06	0.09	----	0.08
June 1965	0.09	0.07	0.08	----	0.05
July 1965	0.13	0.07	0.11	----	0.06
Aug. 1965	0.12	0.09	0.12	0.15	0.12
Sept. 1965	0.10	0.07	0.09	0.12	0.08
Oct. 1965	0.10	0.14	0.10	0.14	0.11
Nov. 1965	0.06	0.10	0.08	0.07	0.07
Dec. 1965	0.06	0.07	----	0.06	0.05
Jan. 1966	0.06	----	0.07	0.06	0.07
Feb. 1966	0.06	----	0.09	0.09	0.07
Mar. 1966	0.09	0.10	0.11	0.10	0.08
April 1966	0.10	0.10	0.15	0.12	0.10
Average, May 1965 - April 1966	0.09	0.09	0.10	0.10	0.08

Figure 13. Sampling site locations.

Note: see Tables 8 and 9 for names of sampling station locations

Figure 14. Averages of monthly averages of one-hour maximum oxidant concentrations.[43]

are based upon an average of 12 monthly values (each of which is itself an average of 30 values). The statistical difference in the two procedures can be overlooked here, since it is the relative pattern of concentrations that is of importance rather than the finite values.

Daily oxidant results are analyzed by the Bureau of Air Sanitation, State Department of Health[43], to determine the number of days each month that the State oxidant standard (0.15 ppm for one hour or more) is equalled or exceeded. The results of that analysis are tabulated in Table 10 for the same sampling stations and the same time period as the oxidant data. In Figure 15, the total number of days on which the standard was equalled or exceeded was plotted for each station, and contour lines produced by interpolation between the various sampling stations.

According to these data, the highest concentrations occur with the greatest frequency in a band of area that reaches across Los Angeles County in the vicinity of Burbank, Glendale, Arcadia, and Azusa, and then drops off flightly in the vicinity north of Pomona at the Los Angeles - San Bernardino County line before building back up again in the vicinity of the cities of San Bernardino and Riverside. From these peak areas, the frequency of high oxidant levels drops off rapidly in the direction of the nearby mountains (to the north and east) and less rapidly in other directions. The shift of the maximum concentrations north and east of the area of maximum emissions is noticeable.

Also noticeable are secondary peaks in average maximum one-hour concentrations in the vicinity of Anaheim-Santa Ana, Carslbad (in northern San Diego County), and the City of San Diego. The State

Table 10. Number of Days Oxidant Concentration Equalled or Exceeded State Ambient Air Quality Standards
December 1966 through November 1967

Station	(Number[b])	Dec '66	Jan '67	Feb '67	Mar '67	Apr '67	May '67	June '67	July '67	Aug '67	Sept '67	Oct '67	Nov '67	Total Dec '66-Nov '67
Downtown Los Angeles	(1)		2	3	4	1	7	7	15	17	5	20	9	90
Azusa	(3)		4	5	10	1	16	20	30	31	22	27	12	178
Pasadena	(4)		3	5	6	1	10	16	28	29	21	24	13	156
Burbank	(5)		1	2	8		14	17	28	29	21	25	13	158
USC Medical School	(6)		2	2	3		5	6	22	17	17	22	6	102
West Los Angeles	(7)		3	4	7		6	5	9	6	7	16	2	65
Long Beach	(8)		1				3			1	1	4	1	11
Hollywood Freeway	(9)			1			4	3	--	--	--	--	--	8
Reseda	(10)	1	2	5	7	3	10	18	28	24	22	21	12	153
Pomona	(11)		1	1	7	1	11	18	27	30	24	24	15	159
Lennox	(12)						3	1	2	1	12			20
Anaheim	(13)		3	6	4	1	5	4	10	12	6	13	10	74
La Habra	(14)		1	3	3	1	9	1			4	10	--	32
Riverside	(15)		1		4	4	18	20	24	28	23	17	14	153
Beaumont	(16)			1			--	--	--	--				1
Corona	(17)			1	3	1	13	12	23	24	16	21	14	128

Table 10 - Continued

Station (Number[b])	Dec '66	Jan '67	Feb '67	Mar '67	Apr '67	May '67	June '67	July '67	Aug '67	Sept '67	Oct '67	Nov '67	Total Dec '66-Nov '67
San Bernardino (18)				6	1	10	16	28	23	11	11	1	107
Upland APCD (19)				2	2	11	11	14	22	12			74
Upland UCR#1 (20)			4	9	2	15	11*	28	29	13	24	17	152
Cucamonga UCR#2 (21)		1	2	7	1	11	19	31	30	21	27	17	167
Chino Airport (22)	--	--	9	3	4	2*	15	15	8	9	9	4	78
San Diego (23)			1	1		1			2	1	1		7
Carlsbad (24)	8	7	13	3		7	2	2	10	5			57
Chollas Heights (25)	3	6	9	3	1	2	2	--	--		3*	1	30
El Cajon (26)		1	3	1			3	3	1				12
Nestor (27)	1	4	6	2		1	2		3	1	4	3	27
Mission Valley (28)						1	2	2	3		4		12
Santa Ana (29)	--	--	--	--	--	1	1		3	1	11	3	20

[a] State standard for oxidant is 0.15 ppm average concentration for one hour

[b] Number in parenthesis arbitrarily assigned for purpose of identification. (see Figure 13)

Note: A blank in a column means zero days on which State standard was exceeded; a dash means that no data was available; an * means that less than a full month's data was available.

Source: The Clean Air Quarterly. Vol. 11, Nos. 2,3,4; Vol. 12, No. 1. Bureau of Air Sanitation, California State Department of Public Health.

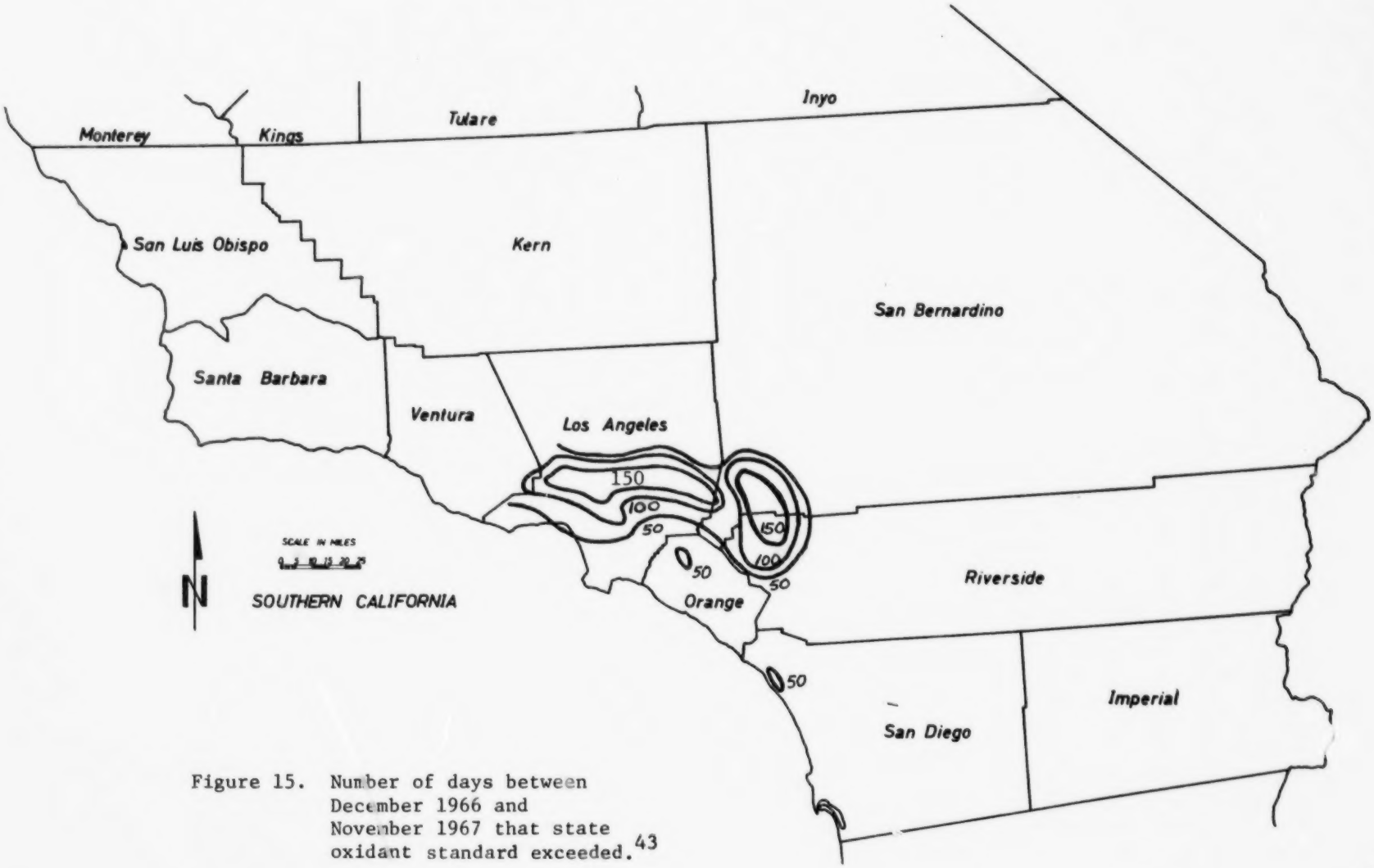


Figure 15. Number of days between December 1966 and November 1967 that state oxidant standard exceeded.[43]

oxidant standard was exceeded on 50 or more separate days in the Anaheim-Santa Ana and Carslbad areas, but on 30 or less days in the San Deigo area (the Chollas Heights sampling station).

Most of the data presented so far has dealt with the present-day (or recent-past) characteristics of the south coastal urban area and with its air pollution problem. The following projections of various measures of urbanization are included so that expected growth can be considered in the designation of the Region. Table 2 (page 19) shows projected population by county for the year 1980. Figure 7 (page 20) shows the projected 1980 freeway system as well as the system in existence in 1960. Figures 16 and 17 show the land use pattern and population density expected by the year 1980.

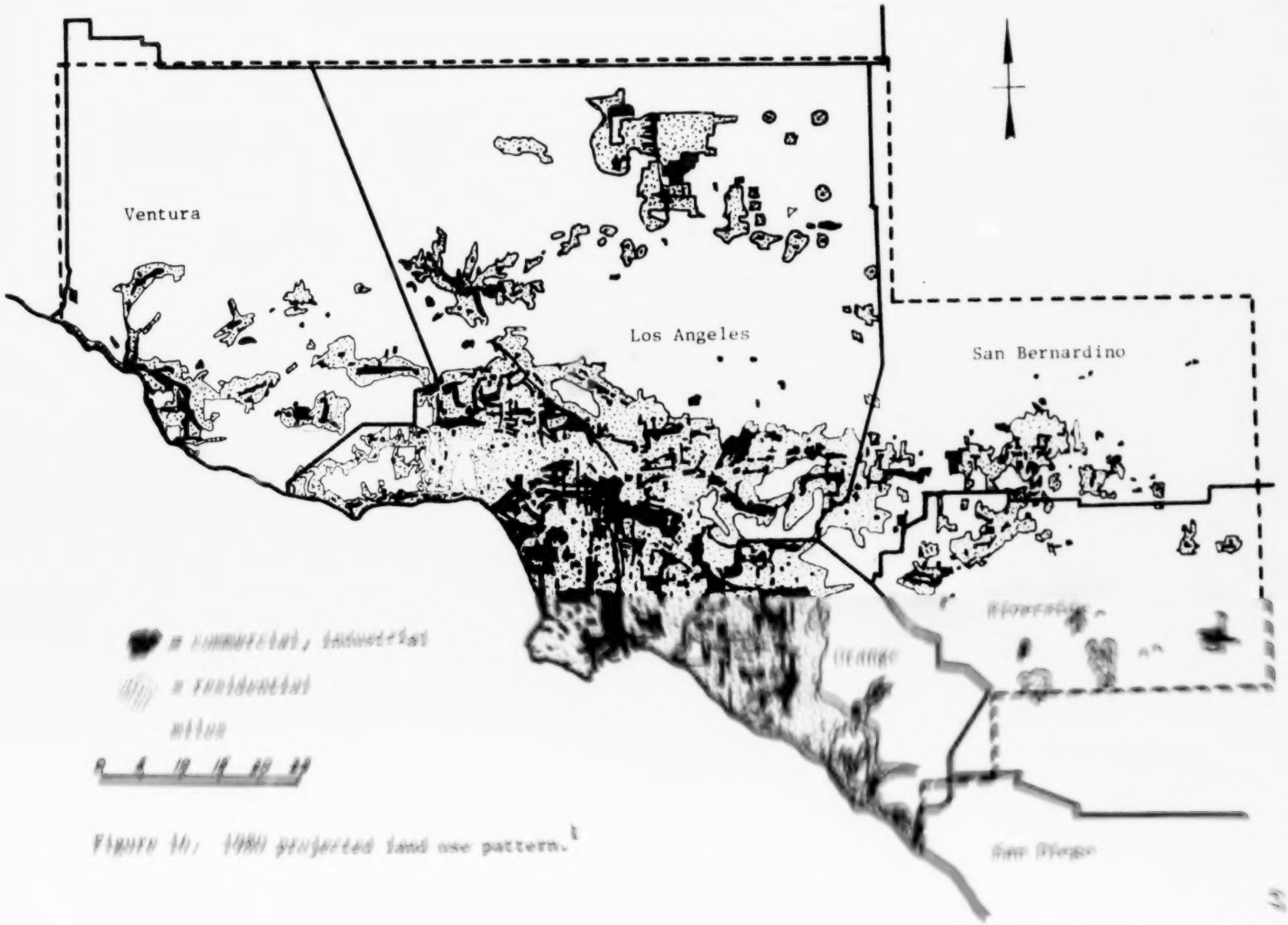


Figure 10: 1980 projected land use pattern.[1]

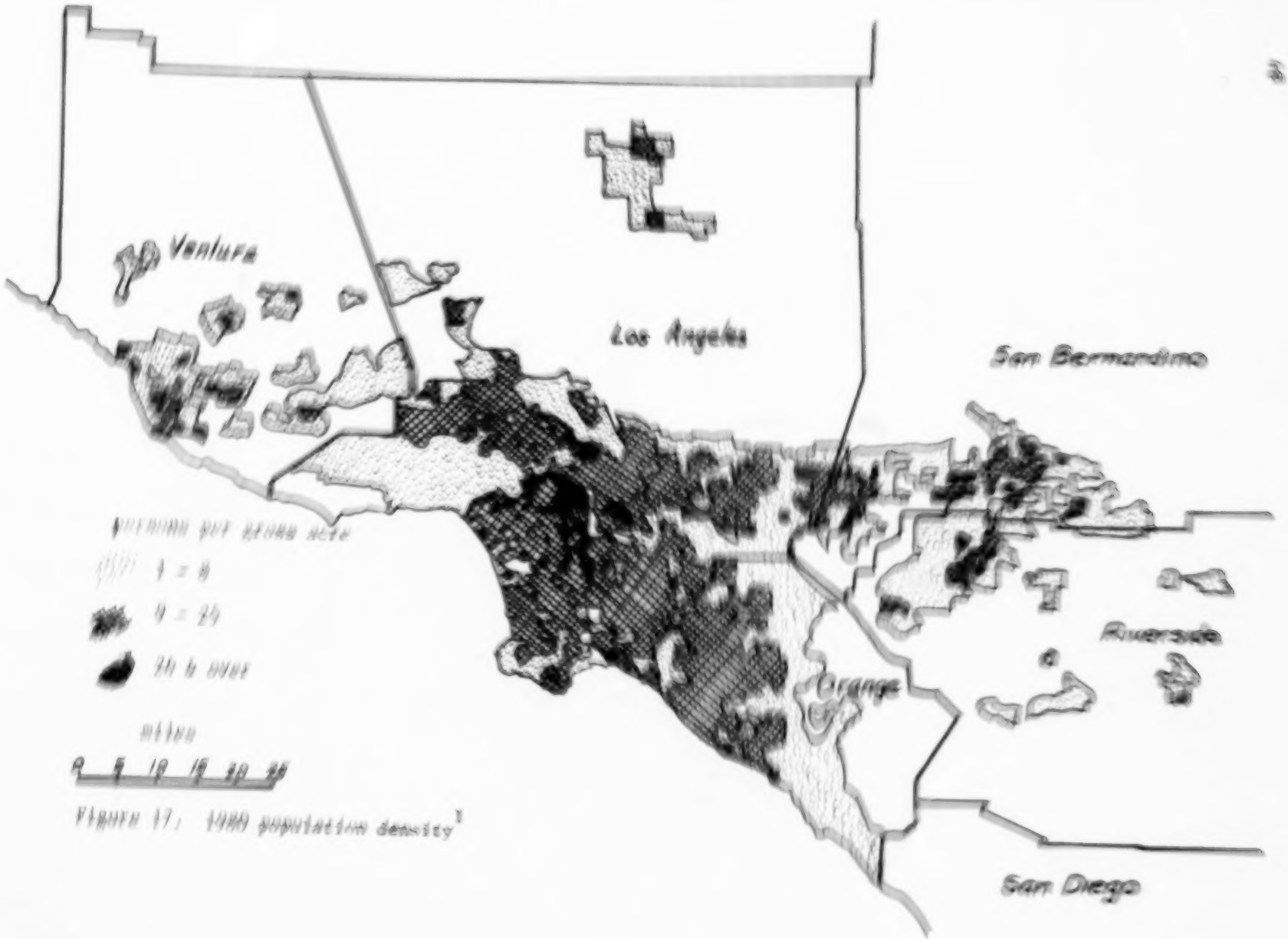


Figure 17: 1980 population density[1]

METROPOLITAN LOS ANGELES AIR QUALITY CONTROL REGION

DISCUSSION AND PROPOSAL

The introduction section of this report discussed in general terms the procedure and the factors leading to the designation of air quality control regions. That discussion can be summarized in the form of two primary requirements: 1) to be successful, a region must include all those areas routinely involved either as sources or as receptors in the air pollution problem, with some consideration of the likely growth of the area in the near future, and 2) beyond the necessity of including all of the problem area, it is necessary to choose the boundaries in a way which is compatible with and even fosters unified and cooperative governmental administration of the air resource throughout the region.

EXTENT OF THE PROBLEM

The following discussion analyzes on a county-by-county basis the data presented in the previous section in order to determine the geographical extent of the problem, thereby fulfilling the first requisite for an effective air quality control region.

Los Angeles County

Los Angeles County, or more specifically, the coastal portion of Los Angeles County, is by every indication the hub of the problem area. Even though its usable land was well developed in 1960, population is expected to increase by almost two million between 1967 and 1980, the highest of any county in the area. While its percentage of the total

is decreasing, the coastal portion of Los Angeles County will still contain over half of the total population of the seven-county area and will continue to experience the highest population density of any jurisdiction considered. Approximately half of the freeway system and half of the total surface transportation facilities of the BART area (see Figure 7) will be located in Los Angeles County. About half of the 236 million average weekday vehicle miles expected in 1990 will be traveled on freeways, and well over half of the freeway travel will occur in Los Angeles County. These factors suggest that well over half of the total pollutant emissions from mobile sources occur in the basin portion of Los Angeles County (see Table 5). This will continue to be the case for some time into the future, although the balance between central Los Angeles County and the surrounding jurisdictions would undoubtedly be changed by completion of the planned rapid transit system.

The coastal portion of Los Angeles County is now and will continue for some time in the future to be the most heavily industrialized part of the urban area. The most recent estimates of pollutant emissions show Los Angeles County to be a major contributor of all the pollutants considered, this in spite of the fact that industry in Los Angeles County is probably the most rigorously controlled in the country.

Oxidant concentrations, probably indicative of the overall air pollution problem in the south coastal area, certainly reflect the highly developed nature of coastal Los Angeles County. The State standard for total oxidants was exceeded on 178 days between December

1966 and November 1967 at the County's Azusa station; the standard was exceeded on every day except one during the July-August time period. The diurnal pattern of windflow and the net transport inland are responsible for the fact that the highest concentrations of oxidants occur to the north and east of the area of highest emissions.

The foregoing discussion has been presented, not to justify the obvious need to include the coastal portion of Los Angeles County in the Region, but so that, by comparison the need to include the north-eastern corner of the County can be evaluated.

The weight of evidence suggests that the technical requirements of the Region can be satisfied without including the Antelope Valley portion of Los Angeles County. It is completely spearated from the balance of the County by the intervening mountains. Its climate and topography are that of the Majave Desert rather th n the coastal area. A 1960 study of the area[44] concluded that the air pollution potential of Lancaster is only half that of Los Angeles and in Palmdale, only one fourth. The same study concluded that the potential for air pollution buildup in the Antelope Valley is greatest in the winter - just the opposite of the coastal part of Los Angeles County (highest potential during July and August).

The inclusion of the Antelope Valley in the Region might be justified in spite of the above factors if the transport of pollutants over the mountains in either direction was significant. Transport of significant quantities of pollutants from the Antelope Valley into the coastal basin can be discounted almost out-of-hand becuase of the low emission levels there and the infrequency of the requisite meteorological

conditions (see Figures A-1 through A-4). There is a greater likelihood of transport eastward from the Oxnard Plain up the Santa Clara River Valley into the upper San Fernando Valley and then over the mountains toward the Antelope Valley. This flow pattern undoubtedly leads to the transport of some pollutants from the Los Angeles Basin over into the Antelope Valley. Still remaining, however, is the frequency with which such transport occurs, and, when it occurs, to what extent it affects Antelope Valley air quality. There is very little data available that bear on these questions. Analysis of the overall air flow pattern in Figure A-1 suggests that most of the air involved in the flow toward the Antelope Valley originates from along the Santa Barbara - Ventura County coastline and as a result is probably not as heavily laden with pollutants as the air further south. This, combined with the turbulent mixing caused by the movement up and over the irregular mountain terrain and the greatly increased mixing depth beyond the mountains, make significant impact on Antelope Valley air quality unlikely.

Ventura County

Next to Santa Barbarb County, Ventura County was the least populated in 1967 of those studied with a population of 330,000. By 1980, however, Ventura County will have over one million residents. Again aside from Santa Barbara, Ventura is the least industrialized of the seven counties now, but its industrial base is expected to increase considerably by 1980.

The coastal portion of Ventura County is related meteorologically to Los Angeles County by the channeled diurnal flow of air up and down the Santa Clara and San Fernando Vallies and by flow back and forth between the two counties along the immediate coast. The free exchange

of air back and forth between the two counties is impeded but not precluded by the Santa Susana Mountains.

The pattern of oxidant concentrations in southern Ventura County is difficult to establish because of the low number of sampling stations, but their results fit well with the pattern in western Los Angeles County. There is, therefore, little doubt that the air quality of that part of Ventura County south of (and including) the Santa Clara Valley is intimately related to the air pollution problem of the Los Angeles area.

There is no technical reason to include the northern half of Ventura County in the Region. It is mountainous and relatively undeveloped. Furthermore, the prevailing air flow pattern does not lead to the transport of Region-generated pollution into the northern part of the county.

San Bernardino County

San Bernardino County, with over 20,000 square miles of area, is the largest county jurisdiction in the county; it exceeds the combined area of the States of Massachusetts, Rhode Island, Connecticut, and New Jersey. Its topography divides it into two distinct areas; approximately 450 square miles of the county are located in the southwest corner, separated from the over 19,000 square miles of desert in the rest of the county by the San Bernardino Mountains. The county had an estimated 1967 population of 668,000 people, of whom, 540,000 lived in the 450 square mile southwest corner, where they have much closer ties to the rest of the Los Angeles Basin than to the rest of San Bernardino County.

The basin portion of the county has experienced a high growth rate

since 1940, and population is expected to almost double between 1967 and 1980. The 540,000 people currently located in the southwest corner of the county make up about six to seven percent of the total population of the south coastal basin area[1] and, according to Table 4, are responsible for approximately eight percent of the total pollutant emissions of the area. The air quality data, and particularly Figure 14, suggest that this portion of San Bernardino is subjected to a disproportionately large share of the oxidant pollution of the Basin. The difference can only be accounted for by transport of the pollutant from other parts of the Basin. It has already been noted that the location of highest concentrations in Los Angeles County is northeast of the area of highest emission, and that the shift can be related to the daytime air flow pattern in the area. The same reasoning accounts for the relatively high oxidant concentrations in San Bernardino County. There is a strong wind vector from west to east during most of the daytime hours that would carry pollution generated in Los Angeles and northern Orange Counties through the passage between the San Gabriel and Santa Ana Mountains to the San Bernardino - Riverside area. Just as there is a daytime transport of pollution from west to east, the reversed, land-to-sea wind pattern at night causes an east-to-west transport of pollutants. Taken together, these two facts make it obvious that the southwest corner of San Bernardino County should be included in the Region.

The same reasoning that was applied to the Angelope Valley can be used to rule out the inclusion in the Region of the desert portion of San Bernardion County on technical grounds. While there is undoubtedly

a net transport of pollutants from southwest to northeast across the mountains, the much greater dilution potential over the desert probably makes the impact of such transport on desert air quality insignificant on all but the most infrequent occasions.

Riverside County

Geographically, Riverside County has much in common with San Bernardino County. The San Jacinto Mountains divide the county into distinct western and eastern parts; the western fourth of the county has the majority of the county's 400,000 residents and is related geographically and meteorologically to the south-coastal Basin. The northwestern corner of the county is more developed than the southwest corner and has higher oxidant pollution levels. Several factors, however, suggest that the entire western portion of the county should be included in the Region: 1) no noteable topographical or meteorological difference between the northwest and southwest sectors; 2) expected growth in the southwest sector of Riverside and in southern Orange County; and 3) the strong west-east wind vector around the southern end of the Santa Ana Mountains.

Inclusion of the eastern, desert portion of Riverside County in the Region on a technical basis, is ruled out by the same factors that lead to the exclusion of most of San Bernardino County.

Orange County

The need to include Orange County in the Region is as obvious as was the need to include Los Angeles. The urban and industrial development of northern Orange County is a continuous extension of the urban development of Los Angeles County. Orange County was the fastest

growing of any in California between 1950 and 1960; it was the second most populous county in the area (excluding San Diego); and it will experience an actual increase in population between 1967 and 1980 second only to Los Angeles County. These factors, plus the relative freedom of the air mass to move back and forth between Los Angeles and Orange Counties make Orange County a logical part of the Region.

San Diego County

Consideration need be given here only to the coastal portion of San Diego County, since the part east of the mountains is eliminated on the same basis as eastern Riverside County. There are two factors favoring the inclusion of western San Diego County in the Region: 1) it is, like all or parts of the other counties discussed, part of the coastal plain of Southern California, with attendant topographical similarities; and 2) the diurnal air flow pattern is such that there is probably a net southern movement of air, and, as a result, a possibility that pollutants released in the Los Angeles - Orange - San Bernardino - Riverside area could eventually affect air quality along the coast of San Diego County. Other factors, however, suggest that San Diego County's air pollution problem is much more its own than it is a part of the Los Angeles area problem. On balance its inclusion on technical grounds does not seem necessary.

The City of San Diego is the center of the county's urban development and is some 120 miles from the center of the Los Angeles area. Aside from residential development along the coast, there is a noticeable discontinuity in urban development in the northern San Diego - southern Orange County area. Because of the land-sea breeze air flow pattern,

there is little opportunity for direct transport of pollutants between the two urban areas. The density of urban development and activities in the City of San Diego area is sufficient in proportion to that of the Los Angeles area to account for the oxidant levels that occur there, thus discounting any major impact of Los Angeles area pollution on San Diego through the over-the-water transport mechanism.

Pollutant levels are generally much lower in San Diego than they are in most of the Los Angeles area, and there are almost an order of magnitude (10 times) fewer days on which various State air quality standards are exceeded in San Diego compared to Los Angeles.

Santa Barbara County

Topography is such that only the narrow southern coast of this county needs to be considered. Approximately half of the county's 250,000 residents live along the south coast - most of them in the City of Santa Barbara. It is by far the least populated and least industrialized of any county considered. There is very little likelihood that Santa Barbara emissions affect in any measureable way the air quality of any part of the Region, with the possible exception of westernmost Ventura County. The only remaining technical reason for including any part of Santa Barbara - transport of Los Angeles air pollution into Santa Barbara = is questionable. The net southern movement of the off-shore air mass would seem to preclude all but occasional transport over the water from Los Angeles to Santa Barbara. Thus, topographical continuity is the only physical or technical reason to include coastal Santa Barbara County in the Region, and it is outweighed by those factors just discussed.

In summary, the requirement to include in the Region those areas routinely involved in the problem either as the site of sources or of receptors, make it necessary to include all of Orange County, and those portions of Ventura, Los Angeles, San Bernardino, and Riverside located in the coastal plain between the ocean and the various mountain ranges. There is not sufficient technical justification to include any part of Santa Barbara or San Diego Counties, or the desert portions of Los Angeles, San Bernardino, and Riverside Counties.

JURISDICTIONAL FACTORS

The legislative mandate that jurisdictional boundaries be considered in the process of designating air quality control regions is reflected in the second major requirement discussed at the beginning of this section, namely that the final location of the boundary should be chosen in a way which is compatible with or even fosters regional coordination of air resource management efforts in the area. In all but one of the air quality control regions proposed prior to this one, this requirement has been satisfied by including a whole county in the region if the technical or engineering analysis indicated that substantial portions of the county were involved in the regional problem, either as the site of sources or of receptors. The consideration of whole counties has two major advantages. First, it tends to provide a perimeter of less-developed land that serves as a buffer zone for future growth. Second, it provides the greatest latitude in the development of jurisdictional responsibility for the administration and enforcement of control efforts in the region.

The one exception to date is the proposed air quality control region for the Denver area. The proposed Region there includes only portions of some counties and, as such, coincides with State-established Denver Air Basin. The desire to encourage the State's regional efforts was not, however, the only or perhaps even the prime factor, though it obviously had bearing on the proposal. The size of the counties was a major factor; those split in the Denver proposal were so large that a decision to include them in their entirety would have extended the region so far beyond the necessary size of the region that the administration of control efforts would have been unnecessarily complicated.

Some of the same factors are pertinent to the Metropolitan Los Angeles Region. There is technical justification for the inclusion of all of Orange County and only parts of Ventura, Los Angeles, San Bernardion, and Riverside Counties. The uninvolved portions of these counties are almost five times the size of the area involved in the problem. Such geographical disparity could be justified only if it appeared necessary to encourage effective administration of control efforts, and this does not appear to be the case.

The State of California is in the final stages of its deliberations on the establishment of "air basins" under the recently-passed Mulford Carroll Act[45]. In its evaluation of the regional patterns of air pollution in California, the State has recognized topography as a primary factor and is, as a result, planning to establish some air basin boundaries that follow topographical features rather than county boundaries. This is true of the South Coast (Los Angeles) Air Basin;

at the time of the preparation of this report, the State's proposed Air Basin would include all of Ventura and Orange and parts of Santa Barbara, Los Angeles, San Bernardino, and Riverside Counties.

As summarized on page 58 , the technical requirements of an air quality control region would be satisfied by including the same area as that proposed by the State of California for its Air Basin, with two exceptions. There is no technical justification for the inclusion of the northern half of Ventura County or the coastal strip of Santa Barbara County.

The difference in Ventura County is easily resolved. Northern Ventura County will probably never be intimately involved in the Region's air pollution problem, but it is even less likely to be involved in the air pollution problem of any adjoining area. This, combined with the desire to include whole counties wherever possible, make the inclusion of the whole county the most logical solution.

The question of Santa Barbara is not so easily solved. It is recognized that the topography, together with considerable industrial and residential growth might necessitate further inclusion, but, for the present and foreseeable future, the need to include it in the Region is not sufficient to justify the splitting of the county.

THE PROPOSED REGION

Based on the foregoing analysis, the Secretary, Department of Health, Education, and Welfare, proposes to designate the Metropolitan Los Angeles Air Quality Control Region, consisting of the following jurisdictions or parts thereof:

1. All of Ventura County

2. All of Orange County

3. That part of Los Angeles County between the coastline and the major ridge line of the Sierra Madre and San Gabriel Mountain

4. That part of San Bernardino County bounded by Los Angeles and Riverside Counties and the major ridge line of the San Gabriel and San Bernardino Mountains

5. That part of Riverside County bounded by San Bernardino, Orange, and San Diego Counties and the San Jacinto Mountains to the east.

As generally defined above, the proposed Metropolitan Los Angeles Air Quality Control Region is identical to the proposed South Coast Air Basin, minus the southern portion of Santa Barbara County. The proposed Region is illustrated in Figure 18 and its official boundary location is described in Appendix B.

The purpose of the scheduled consultation with appropriate State and local officials is to receive comments and suggestions regarding this proposal. Comments of the appropriate State and local officials will be pertinent to the final disposition of the proposal.

Figure 18. Boundary location for proposed Metropolitan Los Angeles Air Quality Control Region.

APPENDIX A

Meteorological Data

TABLE A-1 SEASONAL INVERSION FREQUENCY DATA

Montgomery Field, San Diego
June 1957 - March 1962

Inversion base height (Ft. m.s.l.)	Frequency			
	1400		1600	
	Percent	Number	Percent	Number
		SUMMER		
3001 to 5000	6	29	2	8
2501 to 3000	10	44	4	17
2001 to 2500	13	60	10	47
1501 to 2000	25	115	38	175
1001 to 1500	17	79	31	142
501 to 1000	12	55	14	63
408 to 500	0	0	0	0
Surface (407)	16	75	0	0
		FALL		
3001 to 5000	11	49	10	45
2501 to 3000	3	14	4	17
2001 to 2500	5	21	7	31
1501 to 2000	8	34	14	64
1001 to 1500	7	33	22	98
501 to 1000	5	24	20	90
408 to 500	0	0	0	0
Surface (407)	54	241	1	6
		WINTER		
3001 to 5000	3	15	8	35
2501 to 3000	1	3	3	15
2001 to 2500	1	4	4	17
1501 to 2000	1	6	4	19
1001 to 1500	2	10	11	48
501 to 1000	2	8	22	98
408 to 500	0	0	0	0
Surface (407)	77	345	3	13
		SPRING		
3001 to 5000	18	72	16	64
2501 to 3000	6	22	7	28
2001 to 2500	4	14	11	42
1501 to 2000	6	22	14	54
1001 to 1500	8	33	16	64
501 to 1000	2	7	10	40
408 to 500	0	0	0	0
Surface (407)	42	168	*	1

* Less than 0.5 percent.

TABLE A-2 SEASONAL INVERSION FREQUENCY DATA

Santa Maria
June 1957 - June 1959

Inversion base height (ft. m.s.l.)	Frequency			
	0400		1600	
	Percent	Number	Percent	Number
		SUMMER		
3001 to 5000	3	6	4	9
2501 to 3000	2	5	5	10
2001 to 2500	8	18	8	17
1501 to 2000	18	38	18	38
1001 to 1500	19	40	28	59
501 to 1000	18	38	35	75
239 to 500	0	0	0	0
Surface (238)	32	68	*	1
		FALL		
3001 to 5000	5	9	5	9
2501 to 3000	1	2	3	5
2001 to 2500	2	4	5	8
1501 to 2000	7	12	10	17
1001 to 1500	9	15	14	24
501 to 1000	10	16	39	65
239 to 500	0	0	2	3
Surface (238)	61	100	0	0
		WINTER		
3001 to 5000	3	5	14	25
2501 to 3000	1	2	2	4
2001 to 2500	2	4	5	9
1501 to 2000	3	5	3	5
1001 to 1500	1	1	4	8
501 to 1000	2	3	21	38
239 to 500	0	0	2	3
Surface (238)	76	136	3	6
		SPRING		
3001 to 5000	4	7	8	15
2501 to 3000	6	11	1	2
2001 to 2500	5	10	7	12
1501 to 2000	6	11	18	24
1001 to 1500	8	15	20	37
501 to 1000	3	6	20	37
239 to 500	0	0	0	0
Surface (238)	57	104	1	1

* Less than 0.5 percent

TABLE A-3 SEASONAL INVERSION FREQUENCY DATA

Santa Monica
June 1957 o June 1962

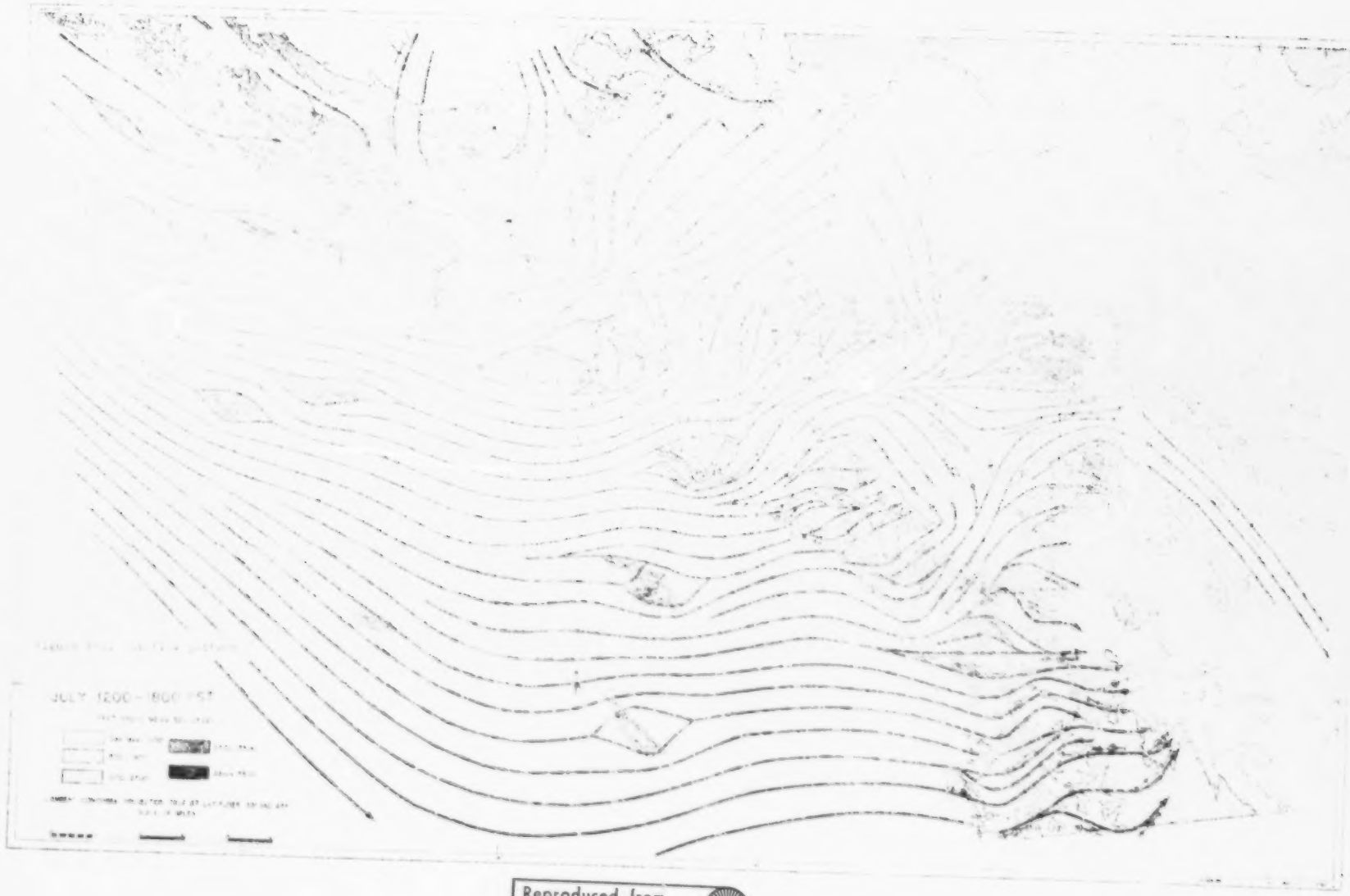
Inversion base height (ft. m.s.l.)	Frequency			
	0400		1600	
	Percent	Number	Percent	Number
		SUMMER		
3001 to 5000	5	2*	3	12
2501 to 3000	7	31	2	7
2001 to 2500	7	34	3	14
1501 to 2000	21	95	9	43
1001 to 1500	22	100	37	169
501 to 1000	16	73	36	165
126 to 500	4	17	9	41
Surface (125)	16	73	*	2
		FALL		
3001 to 5000	8	36	6	27
2501 to 3000	3	12	3	12
2001 to 2500	6	29	3	12
1501 to 2000	6	29	6	27
1001 to 1500	9	39	16	72
501 to 1000	7	34	31	143
126 to 500	48	218	3	12
		WINTER		
3001 to 5000	3	13	8	37
2501 to 3000	2	7	1	6
2001 to 2500	2	7	1	5
1501 to 2000	2	8	3	15
1001 to 1500	2	11	7	30
501 to 1000	3	12	22	98
126 to 500	2	8	12	54
Surface (125)	70	314	5	21
		SPRING		
3001 to 5000	12	49	8	33
2501 to 3000	5	18	2	7
2001 to 2500	6	22	3	13
501 to 2000	8	32	8	33
1001 to 1500	5	20	14	55
501 to 1000	5	21	23	91
126 to 500	2	7	13	50
Surface (125)	38	150	1	3

* Less than 0.5 percent

TABLE A-4 INVERSION FREQUENCY DATA (mid-season months)

0100-0600 PST, Edwards Air Force Base, 1957-1959

Inversion Base height (Ft. m.s.l.)	Frequency	
	Percent	Number
	JULY	
3001 to 5000	0	0
2501 to 3000	0	0
2317 to 2500	0	0
Surface (2316)	96	63
	OCTOBER	
3001 to 5000	2	1
2501 to 3000	2	1
2317 to 2500	0	0
Surface (2316)	91	60
	JANUARY	
3001 to 5000	2	1
2501 to 3000	2	1
2317 to 2500	0	0
Surface (2316)	95	53
	APRIL	
3001 to 5000	4	2
2501 to 3000	0	0
2317 to 2500	0	0
Surface (2316)	96	52



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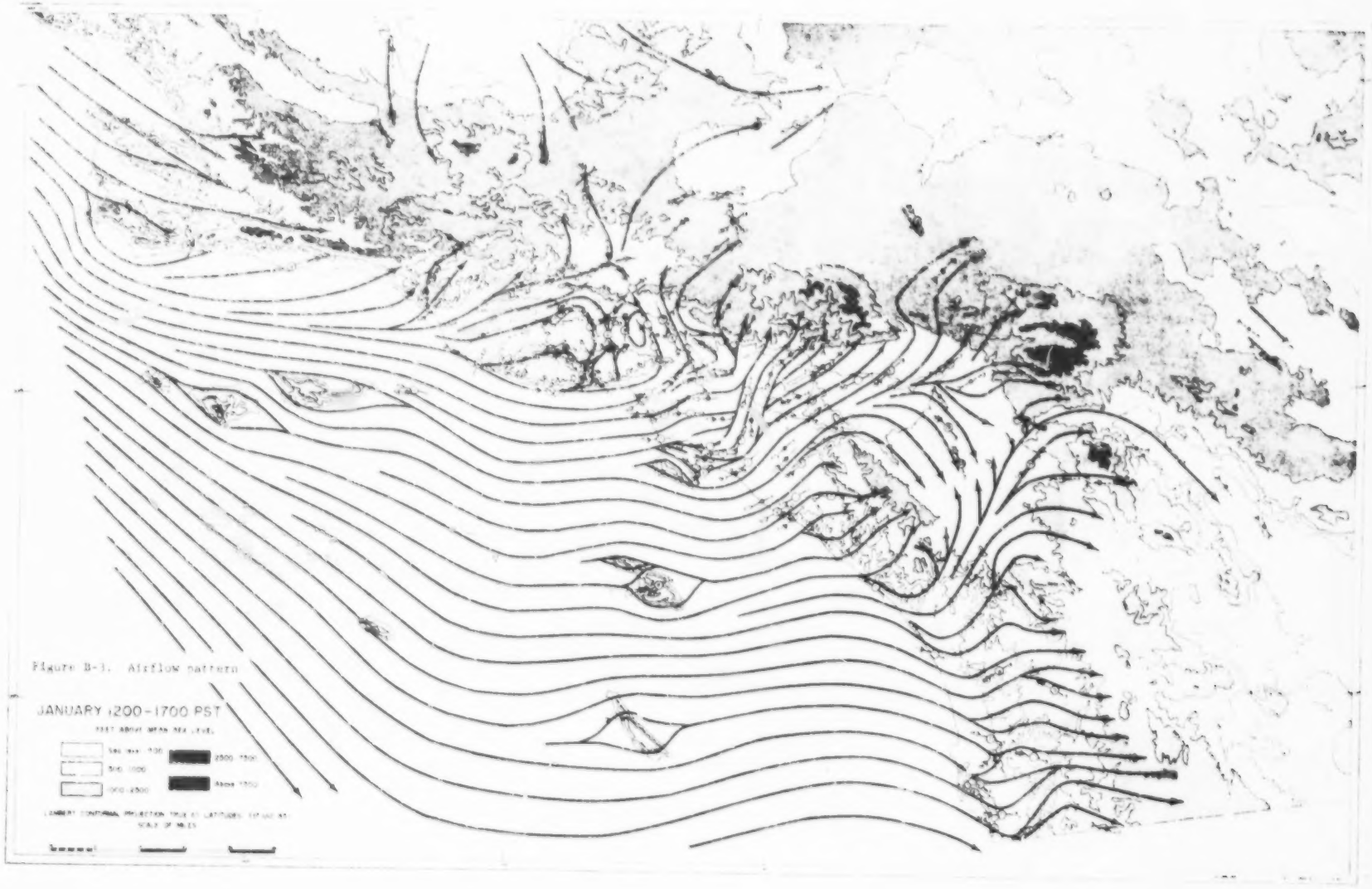

Figure B-1. Airflow pattern

JANUARY 0300 - 0700 PST

APPENDIX B

Official Description of Proposed Air Quality Control Region

Appendix B. Official Description of the Proposed Metropolitan Los Angeles Air Quality Control Region

The proposed Region includes:

1. All of Ventura County.
2. All of Orange County.
3. That portion of Riverside County which lies west of a line described as follows: beginning at the Riverside-San Diego County boundary and running north along the range line common to R.4E and R.3E; then east along the township line common to T.8S and T.7S; then north along the range line common to R.5E and R.4E; then west along the township line common to T.6S and T.7S to the southwest corner of Section 34, T.6S, R.4E; then north along the west boundaries of Sections 34, 27, 22, 15, 10, 3, T.6S, R.4E; then west along the township line common to T.5S and T.6S; then north along the range line common to R.4E and R.3E; then west along the south boundaries of Sections 13, 14, 15, 16, 17 and 18, T.5S, R.[illegible]; then north along the range line common to R.2E and R.3E; then west along the township line common to T.4S and T.3S to the intersection with the southwest boundary of partial Section 31, T.3S, R.1W; then northwest along that line to the intersection with the range line common to R.2W and R.1W; then north to the Riverside-San Bernardino County line.

4. That portion of San Bernardino County west and south of a line described as follows: beginning at the San Bernardino-Riverside County boundary and running north along the range line common to R.3E and R.2E; then west along the township line common to T.3N and T.2N to the San Bernardino-Los Angeles County boundary.
5. That portion of Los Angeles County which lies south and west of a line described as follows: beginning at the Los Angeles-San Bernardino County boundary and running west along the township line common to T.3N and T.2N; then north along the range line common to R.8W and R.9W; then west along the township line common to T.4N and T.3N; then north along the range line common to R.12W and R.13W to the southeast corner of Section 12, T.5N, R.13W; then west along the south boundaries of Sections 12, 11, 10, 9, 8, 7, T.5N, R.13 W to the boundary of the Angeles National Forest which is collinear with the range line common to R.13W and R.14W; then north and west along the Angeles National Forest boundary to the point of intersection with the township line common to T.7N and T.6N (point is at the northwest corner of Section 4 in T.6N, R.14W); then west along the township line common to T.7N and T.6N; then north along the range line common to R.15W and R.16W to the southeast corner of Section 13, 14, 15, 16, 17, 18, T.7N, R.16W; then north along the range line common to R.16W and 17W to the north boundary of the Angeles National Forest (collinear with township line common to T.8N and T.7N); then west and north along the

Angeles National Forest boundary to the point of intersection with the south boundary of the Rancho La Liebre Land Grant; then west and north along this land grant boundary to the Los Angeles-Kern County boundary.

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